THE

AMERICAN NATURALIST.

Vol. V.—SEPTEMBER, 1871.—No. 7.

NOTES ON THE RANGE OF SOME OF THE ANIMALS IN AMERICA AT THE TIME OF THE ARRIVAL OF THE WHITE MEN.*

BY W. J. HAYS.

In the present condition of this country, since civilization has reached half way across the continent, few persons think of the prodigious changes that have taken place in the animal life in the comparatively short time since the discovery of the country. At that time the whole country was an unbroken wilderness, through which roamed the Indians and countless numbers of animals, many of which are now so rare as to be unknown to many and objects of curiosity to all. The moose which has now been driven almost entirely out of the United States, was then found as far south as New Amsterdam, now New York City.

In Sir Martin Frobisher's account of his second voyage to Newfoundland and adjacent land, 1577, he says "There is no wood at all, there is a great quantity of deer, their skins like unto asses, their heads or horns do far exceed any, both in length and breadth, their feet are great as oxen, which measured were seven or eight inches in breadth; there are also hares, wolves, etc."

Anthonie Parkhurst in 1578, says of the Island of Newfoundland, "I saw mighty beasts, like to camels in greatness, and their

* Recently read before the New York Lyceum of Natural History.

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feet cloven." Vanderdonck in his "History of the New Netherlands," 1642, says, "There are also white bucks and does, and others of a black color; the Indians aver that the haunts of the white deer are much frequented by the common deer, and that those of the black species are not much frequented by the common deer." The same peculiarity is noticed now, the moose and common deer are rarely found near each other.

James Hall, in his fourth voyage, July 22d, 1563, saw "in lat. 65, the tracks of some great deer as big as an ox." This shows the extent of the range of the moose at this period. They are not found now in Newfoundland, although they are still abundant in some parts of Canada, Nova Scotia, New Brunswick, and Alaska. The reindeer still exists in large numbers from the Arctic regions to the south end of Hudson's Bay, an average of five thousand horns being annually shipped from Greenland to Europe.

The carraboo abounds now south of Hudson's Bay to the United States, and from Newfoundland to the Pacific; and although fossil remains have been found as far south as the Ohio, its range at the time of the arrival of the white men was no more extensive than at present; the settlers of New Amsterdam knew of it only from the Indians, and from their description of it wrote back to their friends in Europe that the fabled Unicorn had been found.

The musk ox is not mentioned by the early travellers, but some of them mention having seen in Greenland the track of some big beast like an ox. The musk ox is not found now in Greenland.

The common deer (*Cervus Virginianus*) was everywhere represented as existing in incredible numbers; this animal is still found, although in greatly diminished numbers, all over the unsettled portions of the United States, a portion of Mexico, Central America, and South America to the Orinoco. It exists in immense numbers on the savannas of the northern part of South America, although there it is known by another name (*Cervus campestris*). As many as two hundred and fifty thousand have been shipped from Angostura in one year, and one hundred and seventy-five thousand from Para.

The Wapiti deer (*Cervus Canadensis*) was found all along the coast from Canada to the Gulf of Mexico. Vanderdonck mentions them as being plenty around New Netherlands in 1642. In 1654 Father LeMoine made a journey to the western part of New York, and speaks of the astonishing number of the deer, and of the great

numbers of elk, many of which were killed while crossing the rivers. Brickell says that the elk were plenty in the Carolinas as late as 1737. As late as 1826 a few elk were killed on the Saranac, in New York; a few were in the mountains of Virginia in 1847; several were seen in the mountains of Pennsylvania in 1864; now it is probable that not one could be found east of the Great Lakes.

The Bison (improperly called buffalo by the early settlers on account of its fancied resemblance to the European buffalo) also ranged along the coast from the valley of the Connecticut to Florida. When Hendrick Hudson landed on the island of Manhattan, he found some of the Indians clothed in bison robes; they had also moccasins made of these skins.

When he sailed up the river which now bears his name, he landed at what is now the entrance to Newburg Bay; he was well received by the Indians, and one of the sailors happening to show some of the Indians an almanac in which were the signs of the Zodiac, they knew how to explain that it was the head of an animal with which they were acquainted, and gave the whites to understand that it could be found in what is now known as the valley of the Ramapo; the Indians also explained that the animal had already begun to retire from the coast before the white men came here. The river Titicus, in Connecticut, formerly bore the name of Mutighticos, which Indian tradition signified to mean bison creek.

Vanderdonck, in "History of New Netherlands," 1642, says "Buffaloes are also tolerably plenty; these animals keep towards the southwest where few people go. These animals are not very wild, and some persons are of opinion that they may be domesticated. Persons who have got them when young, say they become very tame as they grow older." It is remarked that the half of those animals have disappeared and left the country. The settlers of James River in Virginia also found them, and made an attempt to domesticate them.

Father Simon LeMoine in his journey to the Iroquois in 1654, in which he discovered the Onondaga salt springs, says "that they saw immense herds of cows and bulls." On a map of the Frontiers of the Northern Colonies with the boundary line established between them and the Indians at the treaty held by Sir William Johnson at Fort Stanwix in November, 1768, the west branch of the Susquehanna, and Toby's Creek, a branch of the Ohio, are represented as arising in a swamp called buffalo swamp.

Lawson says that "great plenty of buffaloes, elk, etc., existed near Cape Fear River;" and Purchas says that "in 1613, the adventurers in Virginia discovered a slow kind of cattle as big as kine, which were good meat."

Brickell says that two were taken alive in 1730, near where Newbern now stands; and those who settled the Abbeville district in South Carolina in 1756 found the buffalo there.

Bernard Romans, who wrote in 1774, speaks of the buffalo as a "benefit of nature bestowed upon Florida."

Alvar Nunez, about the year 1535, saw them not far from the coast, and Ioutel in 1685 saw them at the Bay of St Bernard.

De Soto, who traversed the coast of the Gulf of Mexico from Florida to the Mississippi, from 1539 to 1543, saw no buffalo, but frequently saw the skins, and was told that the animal was to the north of them.

Gomara says, that in 1591, they were in great numbers in what is now New Mexico.

Herrera states, that they roamed as far south as the river Yaquinie (supposed to be the Rio Gila).

The buffalo is not found now west of the Rocky Mountains, except a few on the head waters of the Columbia river, but the Indians have a tradition that shortly before the visit of the first explorers destructive fires drove the bison east of the mountains.

Thus, it would seem that the bison once roamed over the entire country, now known as the United States, and extending as far north as the sixtieth parallel in British America. They are not found now east of the Missouri river, nor south of Colorado; at the rate at which they have been driven back and destroyed, it is probable that they are soon to be known only in history.

For many years, the annual number of robes brought to market has been about fifty-five thousand, and when it is known that the skin of the cow only is preserved, and that only in the winter season, and that the cows are generally with calf at this season, and that the skin is not taken from more than one in ten of those animals that are killed, some estimate may be formed of the rapid destruction of these animals at the hand of man; and without taking into consideration the deaths from natural causes, accidents, etc., it is a low estimate to place the number of bison destroyed by man each year at not less than half a million.

It is a little strange that, while the harmless animals have been driven so far back from the Atlantic coast, the carnivorous still

remain, although scarce; the black bear, the cougar, the lynx, wolf, fox, and the smaller animals are still found occasionally. The jaguar is not now found east of Texas. Brickell states that they were found in the mountains of North Carolina as late as 1737.

It has been asserted that the red fox was an importation from Europe, and not a native; it is a fact that the European red fox has been imported and turned loose at different times, by English gentlemen for sporting purposes, but the red fox existed here before the arrival of the white men. Capt. James Hall, in the account of his fourth voyage 1563, says, "there are store of foxes in the main and islands, of sundry colors." Capt. Luke Fox found an island near the mouth of Hudson's Bay, where he killed several dun colored foxes, and on this account called the island "Dunne Foxe Island."

Carver 1763, says, "there two sorts of foxes in North America, one being of a reddish brown and the other of a gray."

Bartram 1761, says, "The foxes of Carolina and Florida are of the smaller red species."

Wolves are everywhere mentioned, and as late as 1820, the State of New York alone had expended thirty-eight thousand two hundred and sixty dollars in bounties for killing these animals during the preceding five years.

Stevens, 1708, says, "some years ago there were killed five hundred bears in two counties of Virginia."

The beaver was very abundant. Vanderdonck 1642, says, "That in the New Netherlands, and in the adjacent country, about eighty thousand beavers have been killed annually during my residence of nine years in the country."

The dog was found in all parts of the country, and from the description must have been the same as those now found with the Indians of the plains.

Columbus, in his second voyage, 1494, says, "no four-footed animal has ever been seen in this (Hispaniola) island or any other islands except some dogs of various colors, as in our own country, but in shape like large house dogs." These semi wild dogs have followed the Indians, and are only to be found with them in the far west. The wild animals having been removed in the march of civilization to make room for the domestic varieties that are more useful to man, it will, perhaps, be in place to say a word about their introduction to this country.

The first known to have been brought here, was by a colony of Northmen, in 1023, who settled in a portion of New England which they called Vineland; they brought with them a variety of stock, but as the colony afterwards broke up and returned to Iceland, and none of the subsequent settlers have ever seen anything like our domestic animals, it is to be presumed that they were destroyed. Columbus, in his second voyage 1493, brought to the islands horses and other domestic animals. The first horses brought to the mainland, were those brought to Florida in 1527, by Cabeca de Vaca, forty-two in number, but these all perished. The next were three hundred and fifty horses landed by De Soto on the 25th of May, 1539, on the coast of Florida, at the bay of Spiritu Sancto.

In 1604 L'Escarbot, a French lawyer, brought horses and other domestic cattle into Acadia; they were the Norman and Breton breeds.

In 1609 six mares and a horse were brought to Jamestown.

In 1629 horses were brought to Massachusetts from England.

In 1625 New Amsterdam received some Dutch horses.

The animals thus imported increased very rapidly, for Gent, who wrote in 1655, says "In the island of Hispaniola and ('tis likewise the same in many parts of the Continent, and other islands beside), there are many thousands of cattle that live wild in herds upon the mountains having no certain owners, so that it is free for any one to kill them that will, and thousands of them are every year killed only for their hides and tallow, and yet it is strange to consider what great multitudes of them are in private men's possession. The Bishop of Venezuela only is said to have had at one time sixteen thousand head of cattle feeding upon his own pastures."

In the year 1587 there came from St. Dominique thirty-five thousand four hundred and forty-four hides, and from New Spain sixty-four thousand three hundred and fifty. At this time it was said that in the islands of Hispaniola, Jamaica, Marguerita and Dominica "there were so great troops of horses, oxen, kine, dogs, and hoggs which have increased to such an extent that any one may kill them, the dogs have so increased that they travel in troops and kill many cattle."

These few facts from history will show how entire races of animals can be swept from the earth to be replaced by others.

LIFE AT GREAT DEPTHS.

BY PROFESSOR P. M. DUNCAN.

THE researches of Hooker, who obtained Polyzoa and Foraminifera in soundings at a depth of nearly four hundred fathoms off the icy barrier of the South Pacific, of Wallich in the Atlantic, and of Alphonse Milne-Edwards in the Mediterranean, have had much influence upon geological thought in this age, which, so far as geologists are concerned, is remarkably averse to theory. For many years before any very deep soundings had been taken with the view of searching the sea-bottom for life, geologists had more or less definite opinions concerning the deposition of organisms in sediments at great depths. Certainly more than thirty years ago deep-sea deposits were separated by geologists from those which they considered to have been formed in shallower seas. The finely divided sediment of strata containing Crinoids, Brachiopods, Foraminifera, and simple Madreporaria, was supposed to have been deposited in deeper water than formations containing large pebbles, stones, and the mollusca whose representatives now live in shallows. The relations of such strata to each other during subsidence, the first being found occasionally to overlap the last, proved that there was a deeper sea-fauna in the offing of the old shores which were tenanted by littoral and shallow-water species. The deposition of strata containing Foraminifera, Madreporaria, and Echinodermata, whose limestone is remarkably free from any foreign substances, has been considered to have taken place in very deep water; this theory has been founded upon the observations of the naturalist and mineralogist. Indeed no geologist has hesitated in assigning a great depth to the origin of some deposits in the Laurentian, Silurian, or in any other formation. The "flysch," a great sediment of the Eocene formation, has been considered to have been formed at a very great depth and under great pressure. Its singularly unfossiliferous character was supposed to be due to the absence of life at the depths of the ocean where the sediment collected. But this was a theory of the early days of geology, when the destructive influence of chemical processes in strata upon the remains of organisms in them was hardly admitted.

The great value of such researches as those so ably carried out by Thomson, Carpenter, and Jeffreys is the definite knowledge they impart to the geologist, who is theorizing in the right direction, but whose notions of the depth at which the sediments containing invertebrata can be deposited are indefinite. These researches contribute to more exact knowledge, and they will materially assist the development of those hypotheses which are current amongst advanced geologists into fixed theories. I do not think that any geological theory worthy of the term, and which has originated from geological induction, will be upset by these careful investigations into the bathymetrical distribution of life and temperature. The theories involving pressure and the intensity of the hardness of deep-sea deposits will suffer from the researches; but many difficulties in the way of the palæontologist will be removed. The researches tend to explain the occurrence of a magnificent deep-sea coral fauna in the Palæozoic times in high latitudes, and of Jurassic and Cainozoic faunas on the same area, and they favor the doctrines of uniformity. They explain the cosmopolitan nature of many organisms, past and present, which were credited with a deep-sea habitat, and they afford the foundations for a theory upon the world-wide distribution of many forms during every geological formation.

It is not advisable, however, to make too much of the interesting identities and resemblances of some of the deep-sea and abyssal forms with those of such periods as the Cretaceous, for instance. In the early days of geological science there was a favorite theory that at the expiration of a period the whole of the life of the globe was destroyed, and that at the commencement of the succeeding age a new creation took place. There were as many destructions and creations as periods; or, to use the words of an American geologist, there was a succession of platforms. This theory held back the science, just as the theory that the sun revolved round the earth retarded the progress of astronomy. Moreover it had that armour of sanctity to protect it which is so hard to pierce by the most reasonable opposition. Nevertheless every now and then a geologist recognized the same fossils in rocks which belonged to different periods. A magnificent essay by Edward Forbes on the "Cretaceous Fossils of Southern India," a wonderful production and far before its age * gave hope and confidence to the few palæ-

* Quarterly Journal of the Geological Society of London, vol. i. p. 79.

ontologists who began to assert that periods were perfectly artificial notions — that it did not follow, because one set of deposits was forming in one part of the world, others exactly corresponding to it elsewhere, so far as the organic remains are concerned, were contemporaneous — and that life had progressed on the globe continuously and without a break from the dawn of it to the present time.

The persistence of some species through great vertical ranges of strata, and the relation between the world-wide distribution of forms and this persistence, were noticed by D'Archiac, De Verneuil, Forbes and others. The identity of some species in the remote natural-history provinces of the existing state of things was established in spite of the dogmatic opposition of authorities; and then geologists accepted the theories that there were several natural-history provinces during every artificial period, that some species lived longer and wandered more than others, and that some have lasted even from the palæozoic age to the present.

Persistence of type was the title of a lecture delivered by Professor Huxley* many years ago; and this persistence has been admitted by every palæontologist who has had the opportunity of examining large series of fossils from every formation from all parts of the world.

Geological ages are characterized by a number of organisms which are not found in others, and by the grouping of numerous species which are allied to those of preceding and succeeding times, but which are not identical. Certain portions of the world's surface were tenanted by particular groups of forms during every geological age; and there was a similarity of arrangement in this grouping under the same external physical conditions. To use Huxley's term, the "homotaxis" of certain natural-history provinces during the successive geological ages has been very exact. The species differed; but there was a philosophy in the consecutive arrangement of high-land and low-land faunas and floras, and those of shallow seas, deep seas, oceans and reef-areas. The oceanic† conditions, for instance, can be traced by organic remains from the Laurentian to the present time, and the deep-sea corals now under consideration are representative of those of older deep seas.

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* Royal Institution. See also President's Address, Geol. Soc., 1870.

† P. M. Duncan, Quar. Jour. Geol. Soc., No. 101.

It is not a matter for surprise, then, that there being such a thing as persistence of type and of species, some very old forms should have lived on through the ages, whilst their surroundings were changed over and over again. But this persistence does not indicate that there have not been sufficient physical and biological changes during its lasting to alter the face of all things enough to give geologists the right of asserting the succession of several periods. The occurrence of early Cainozoic Madreporaria in the deep sea to the northwest of Great Britain only proves that certain forms of life have persisted during the vast changes in the physical geography of the world which were initiated by the upheaval of the Alps, the Himalayas, and large masses of the Andes. To say that we are, therefore, still in the Cainozoic or Cretaceous age would hardly be consistent with the necessary terminology of geological science.

During the end of the Miocene age and the whole of the Pliocene, the Sicilian area was occupied by a deep sea. The distinction between the faunas of those times and the present becomes less, year after year, as science progresses; and it is evident that a great number of existing species of nearly every class flourished before the occurrence of the great changes in physical geology which have become the artificial breaks of tertiary geologists. That the Cainozoic deep-sea corals should resemble, and in some instances should be identical in species with, the forms now inhabiting vast depths, is therefore quite in accordance with the philosophy of modern geology. Before the deposition of the Cainozoic strata, and whilst the deep-sea deposits of the Eocene age were collecting in the Franco-British area, there was a Madreporarian fauna there, which was singularly like unto that which followed it, both as regards the shape of the forms and their genera. Still earlier, during the slow subsidence of the great Upper Cretaceous deep-sea area there was a coral fauna in the north and west of Europe, of which the existing is very representative. The simple forms predominate in both faunas. Caryophyllia is a dominant genus in either; and a branching Synhelia of the old fauna is replaced in the present state of things by a branching Lophohelia. The similarity of deep-sea coral faunas might be carried still further back in the world's history; but it must be enough for my purpose to assert the representative character and the homotaxis of the Upper Cretaceous, the Tertiary, and the existing deep-sea

coral faunas. This character is enhanced by the persistence of types; but still the representative faunas are separable by vast intervals of time.—*Proceedings of the Royal Society.*

ON THE FOOD AND HABITS OF SOME OF OUR MARINE FISHES.

BY PROFESSOR A. E. VERRILL.

When we consider the great importance and extent of our fisheries, it seems very remarkable that so little reliable information has been recorded concerning the habits, even of our most common and important species of fishes. It is certainly true that the habits of fishes, and especially of marine fishes, are more difficult to observe than those of birds and beasts, but this ought not to be a sufficient excuse at the present day, for the marked neglect of this department of Natural History. The nature of the food of the more abundant species, even including those that are most commonly sold as food, is still very imperfectly known. Observations must be made in great numbers in various localities and at all seasons of the year before we can obtain adequate knowledge of this subject.

During several years past I have improved such opportunities as have occurred to make observations of this kind, and although they are very incomplete, and often isolated, I am induced to present some of the facts thus ascertained; hoping that the attention of others may be directed to the same subject.

While spending a few days at Great Egg Harbor, on the coast of New Jersey, in April of this year, I dissected the stomachs of many specimens of the common fishes, which were at that time being taken in seines in the shallow waters of the bay, near Beesley's Point. The following were the principal results, in regard to their food. The Striped-bass or "Rock" (*Roccus lineatus* Gill) had its stomach filled with large quantities of shrimp (*Crangon vulgaris*) unmixed with any other food. This shrimp is very abundant on all sandy bottoms in shallow water along the whole coast, from Labrador to Cape Hatteras, and seems to contribute very largely to the food of many of our most valuable fishes.

White Perch (*Merone Americana*) contained the same shrimp in abundance.

Weak-fish (*Cynoscion regalis* Gill), called "Blue-fish" at that locality had its stomach filled with the same Crangon.

Kingfish (*Umbrina regalis*), called "Hake" on the New Jersey coast, contained nothing but *Crangon vulgaris*.

Toad-fish or Oyster-fish (*Batrachus tau*). This fish is almost omnivorous. The stomach is large and usually distended with a great variety of food. Young edible crabs (*Callinectes hastatus* Ordw.) up to two inches across, *Crangon vulgaris*, and the common prawn (*Palæmon vulgaris* Say), were the principal articles of diet at that locality; but pipe-fishes (*Syngnathus Peckianus*) six inches long, and the common black Nassa (*Ilyanassa obsoleta*) were often found in their stomachs, as well as various young fishes. Among the latter were specimens of the Anchovy (*Engraulis vittata*). The toad-fish is, therefore, a fish that should not be encouraged.

The Shad (*Alosa tyrannus* Gill) contained large quantities of fragments of small crustacea, chiefly a small shrimp-like species (*Mysis Americanus* Smith) which was also captured alive in tide-pools on the salt marsh. The shad from the mouth of the Connecticut River, taken in May, contained the same, or another allied species of *Mysis*. Some of the shad also had fragments of eel-grass (perhaps accidental) mixed with the crustacean fragments.

The "Hickory Shad" (*Meletta Mattawocca*), the young called "Herring" at the locality, were also filled with comminuted crustacea, among which the common shrimp (*Crangon vulgaris*) could be recognized most commonly.

The Moss-bunker or Menhaden (*Brevoortia Menhaden* Gill), invariably had its stomach and voluminous intestine filled with the soft, oozy mud, containing a large proportion of organic matter, which abounds in the quiet part of this and all similar bays along the coast. This fish appears, therefore, to obtain its nutriment by swallowing the mud and digesting the organic particles contained in it,—a mode of feeding for which its complex digestive apparatus and toothless mouth are specially adapted. Many marine worms, bivalve mollusks, and echinoderms feed upon the same kind of food, which is everywhere abundant. The moss-bunker is often infested by a large parasitic Lernean (*Lernocera radiata* Les.) which buries its star-shaped head deeply in the flesh.

The "Summer Flounder" (*Chænopsetta ocellaris*) contained abundance of shrimp (*Crangon vulgaris* and *Mysis Americanus*). In one specimen we found a full-grown *Gebia affinis* Say.

The Spotted Flounder (*Lophopsetta maculata* Gill) feeds largely upon crustacea of various kinds. Many specimens contained large quantities of shrimp and prawns (*Crangon vulgaris*, *Palæmon vulgaris* and *Mysis Americanus*). The latter often made up the bulk of the contents of the stomach. In addition to these *Gammarus mucronatus* Say and *Gebia affinis* Say were sometimes found. The Gebia we obtained in considerable numbers by digging them out of their long, crooked burrows at low-water mark, near Mr. Peacock's hotel at Beesley's Point. The burrows, which are made in a tenacious clay soil, often with decaying sea-weed beneath, are from half an inch to nearly an inch in diameter, with smooth walls. They are several feet in depth and very long and tortuous. The Gebia has a distant resemblance to a young lobster about two or three inches long. The real lobster was not found on the New Jersey coast. The other species of crustacea found in the fishes above named, are all common in the shallow waters of the bay among eel-grass, with the exception of the *Crangon vulgaris*, which frequents the open sandy bottoms, living half buried in the sand, with which its color exactly accords, furnishing an excellent illustration of imitative adaptation for protection.*

Ophidium marginatum DeKay. This species appears to be very rare and its habits little known. We dug two specimens out of the sand near low-water mark, where they burrowed to the depth of a foot or more. When placed upon moist sand they burrowed into it *tail foremost* with surprising rapidity, disappearing in an instant.

At Fire Island on the southern side of Long Island, Mr. S. I. Smith observed last August a species of worm (*Heteronereis*) of a reddish color and two or three inches long, swimming in large numbers at and near the surface. These were at that time the favorite food of the Blue-fish (*Temnodon saltator*).

* Many other crustacea of our coast afford similar instances. *Palæmon vulgaris* by its transparency and peculiar tints is scarcely distinguishable among eel-grass; *Idotæa irrorata* imitates in all its varied patterns of color the eel-grass and sea-weeds on which it lives; *I. cæca* imitates the color of sand; two species allied to *Sphæroma* imitate the colors of the rocks and white barnacles among which they live; *Crangon boreas* of the northern coast, imitates the colors of the red Nullipores among which it seeks concealment, as do also several species of *Hippolyte*, *Chiton ruber* and *C. marmoreus*, *Ophiopholis aculeata* and *Ophioglypha robusta*. Numerous other instances might be given.

At Eastport, Me., and Grand Menan during several years past, I have made many observations on this subject, but mostly relating to fishes of which the habits are better known, like the cod, hake, haddock, etc.

The Wolf-fish (*Anarrhicas vomerinus*) is not at all particular as to its food. At Eastport I took from the stomach of a large one at least four quarts of the common round sea-urchin (*Euryechinus Dröbachiensis* V.), most of them with the spines on, and many of them quite entire. From another, I took an equal quantity of a mixture of the same sea-urchin and the large whelk (*Buccinum undulatum*). Many of the latter were entire or but slightly cracked.

The Sculpins not unfrequently swallow entire large specimens of several crabs (*Cancer irroratus*, *Hyas coarctatus*, etc.).

The Haddock is addicted to the same habit, but is a very general feeder, swallowing all sorts of mollusca, worms, fishes, etc.

The Herring (*Clupea elongata*) in the Bay of Fundy feeds very extensively, at least during all the months when I have observed them (June to November), upon several species of *Mysis* and *Thysanopoda*, called "shrimp" by the fishermen. These swim free at and near the surface in extensive "schools" and are persistently pursued by the Herring. The commonest species, apparently a *Thysanopoda*, is about an inch and a half long, of a pale reddish color. The species of *Mysis* are smaller and paler. The two genera often occur together. Young Pollock or Coal-fish, four to ten inches long, pursue the same species in large schools, often coming around the wharves of Eastport in great numbers in eager pursuit of their prey, and by leaping out after them produce a great commotion in the water. When thus pursued the *Thysanopoda* will leap out of the water to the height of a foot or more. The common *Sebastes*, or "Red Perch" at Eastport, feeds upon the same species when they come around the wharves, but probably does not pursue them to the same extent as the herring and pollock.

POLYMORPHIC FUNGI.

BY M. C. COOKE.

It is now generally admitted that a great many fungi, formerly regarded as good and distinct species, are in reality, only conditions

or stages of other forms. It has been proved beyond doubt that many species of fungi are truly polymorphic, appearing under different phases. It is, notwithstanding all this, most premature and unjustifiable to conclude, as some have done, that there are no good species at all, or that there is no certainty whatever in the study. Whilst admitting that many of our old notions have been overturned, that what at one time we hardly deemed possible has been proved to take place, we are not prepared to go the length of some, whose knowledge of the subject falls far short of their assumption. It is not very long since that one writer gravely asserted his opinion that all the British species of *Æcidium*, for instance, would be reduced to a single species; that, in fact, there was no sound specific distinction between them. This opinion originated probably rather in prejudice than as the result of study and investigation. Others have lumped together a host of unassociated species, without satisfactory evidence, and declared them to be only the same thing under different conditions. Hasty generalizations in this, as in other cases, produce more harm than good.

It is exceedingly difficult to trace such minute organisms as fungi, especially moulds, and to prove, without doubt, that they are conditions, the one of the other. It is easy enough to sow the spores of a certain Mucedine on paste, or potato, or any other matrix, cover them carefully, and watch the result; then, if the common *Aspergillus* or *Penicillium* makes its appearance, to some minds it is at once conclusive that the said Mucedine is only a condition of *Aspergillus* or *Penicillium*. Such a conclusion is not only rash, but mischievous, and far from the truth. There is no evidence that the *Aspergillus* or *Penicillium* originated from the spores of the Mucedine which were sown, but perhaps never germinated. When two moulds proceed apparently from the self-same mycelium, judgment may be pronounced too hastily, for the mycelium of both *may* be distinct, though interlaced together; the safest conclusion being based on two forms of fruit when developed upon the same thread. Beyond this, there is always room for doubt. Hence it will be seen how difficult it is to prove dimorphism in moulds under such conditions. In many cases it is more presumption than proof. These remarks are not made with the view of discrediting the conclusions of such observers as Prof. De Bary and the brothers Tulasne, but rather as a caution against assuming as fact that which is only conjecture.

Messrs. Tulasne, in their splendid work, "Selecta Fungorum

Carpologia," have given a great number of instances of polymorphism. We have no reason to doubt that in many cases, perhaps most, they are quite correct, but even some of their conclusions require verification before they can be accepted as established fact. As an illustration of the results determined with regard to one species by these authors, we may instance the very common *Sphæria* (*Plœospora*) *herbarum*. It occurs on the dead stems of herbaceous plants, on the leaves of some trees, and even sometimes on decaying *Algæ*. On pea and bean stems it is usually plentiful. In fact, it is almost the commonest *Sphæria*, and easily recognized. The sporidia are, of course, contained in elongated, transparent, membranaceous asci; they are of a yellowish-brown or amber color, ovate-oblong, and divided by numerous septa, with transverse divisions. The asci are enclosed within carbonaceous perithecia.

Equally as common, and even more so, is a mould which forms sooty or dark olive spots, or patches, on all kinds of decaying vegetable substances. This is called *Cladosporium herbarum*. It may be characterized as cosmopolitan, and one of the commonest, if not the commonest, of fungi. Under the microscope this mould consists of a profuse mycelium, from which arise tufts of jointed threads, mixed with elliptical or elongated spores, ultimately septate. This mould is one condition, according to M. Tulasne, of *Sphæria herbarum*.

Another condition of the same plant is a very pretty mould found mixed with, or parasitic upon, the *Cladosporium*, and known as *Alternaria tenuis*. This species is figured in Corda's "Prachtflora," and consists of chains of spores resembling inverted jointed clubs. The joints are also transversely divided, as in the *Sphæria* sporidia.

A third form of the same species is that named by Rev. M. J. Berkeley, *Macrosporium sarcinula*, which is developed on decaying gourds. The spores are clavate, at length somewhat rectangular, with numerous septa, constricted, and very variable, both in size and in the number of cells.

Besides these, there are certain "distinct papillate, or bottle-shaped cysts, which contain naked spores, capable of germination." So that altogether we have five different forms of fungi, all of which are but stages or conditions of one and the same thing. It is very probable, that, in addition to these, *spermatia* may also hereafter be discovered, or traced to some already known Coniomyce-

tous species. From this example it will be readily understood what we mean when writing of "polymorphic fungi."

Fig. 76.

Penicillium chartarum, considerably magnified; *a*, portion of chain of spores.

Having thus, as it were, defined our terms, we will proceed to notice two instances of apparent polymorphism which have come before us. We say "apparent" advisedly, because in the second instance only suspicions can be predicated. Some two or three years ago, we collected a quantity of dead box-leaves, on which grew a mould named by Link, *Penicillium roseum*. This mould has a roseate tint, and occurs in patches on the leaves; the threads are erect and branched above, bearing oblong, somewhat spindle-shaped, spores. When collected these leaves were examined, and nothing was observed or noted upon them except the Penicillium. After some time, certainly between two and three years, during which the box remained undisturbed, circumstances led to the examination again of one or two of the leaves, and afterwards of the greater number of them, and the patches of Penicillium were found to be intermixed with another mould of a higher development and far different character (Fig. 77). This mould or rather Mucor, for it belongs to the Mucorini, consists of erect branching threads, many of the branches terminating in a delicate, globose, glassy head, or sporangium, containing numerous very minute subglobose sporidia. This species has been named *Mucor hyalinus*. The habit is very much like that of the Penicillium, but without any roseate tint. It is almost certain that the Mucor could not have been present when the Penicillium was examined, and the leaves on which it had grown were enclosed in the

Fig. 77.

Fertile thread of *Mucor hyalinus*, bearing sporangia.

tin box, but that the Mucor afterwards appeared on the same leaves, sometimes from the same patches, and from the same mycelium. The great difference in structure of the two species lies in the fructification. In Penicillium, of which fig. 76 is a good illustration, the spores are naked, and in moniliform threads, whilst in Mucor the spores are enclosed within globose membranous heads or sporangia, as shown in fig. 77. The moulds, or Mucedines to which Penicillium belongs, are included in one of the large families of fungi termed *Hyphomycetes*, and the Mucors belong to another family, the *Physomycetes*. We entertain no doubt whatever, that the Mucor, to which we have alluded as growing on box-leaves, intermixed with *Penicillium roseum*, is no other than the higher and more complete form of that species, and that the Penicillium is only its conidiiferous state. The presumption in this case is strong, and not so open to doubt as it would be, did not analogy render it so extremely probable that such is the case, apart from the fact of both forms springing from the same mass of mycelium. In such minute and delicate structures it is very difficult to manipulate the specimens so as to arrive at positive evidence. If a filament of mycelium could be isolated successfully, and a fertile thread, bearing the fruit of both forms, could be traced from the same individual mycelium thread the evidence would be conclusive. In default of such conclusive evidence, we are compelled to rest with the assumption until further researches enable us to record the assumption as fact.

In Lewis's recent "Report on Microscopic Objects found in Cholera Evacuations" (Calcutta, 1870), a similar instance of presumed dimorphism between precisely the same genera is thus recorded. "On a preparation preserved in a moist chamber, on the third day a white speck was seen in the surface consisting of innumerable 'yeast' cells with some filaments, branching in all directions. On the fourth day, tufts of Penicillium had developed — two varieties, *P. glaucum* and *P. viride*. This continued until the ninth day, when a few of the filaments springing up in the midst of the Penicillium were tipped with a dew-drop like dilatation, excessively delicate — a mere distended pellicle. In some cases they seemed to be derived from the same filament as others bearing the ordinary branching spores of Penicillium, but of this I could not be positive. This kind of fructification increased rapidly, and on the fourteenth day *spores* had undoubtedly developed

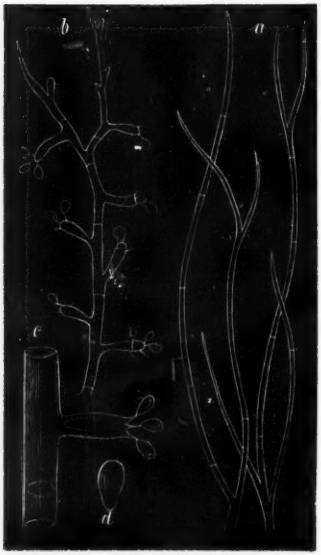
within the pellicle, just as had been observed in a previous cultivation, precisely similar revolving movements being also manifested." Here we have another example of a Mucor developed from a Penicillium, and one observation strengthens and confirms the other.

Before entering upon the details of the second apparent polymorphism, it may be as well to give some particulars of the circumstances under which the fungi appeared. It was our fortune — *good* fortune as far as this investigation is concerned — to have a portion of wall in our dwelling persistently damp for some months; it was close to a cistern that became leaky. The wall was papered with "marbled" paper, and varnished. At first there was for some time — perhaps months — nothing worthy of observation except a damp wall; decidedly damp, discolored, but not by any means mouldy. At length, and rather suddenly, patches of mould, sometimes two or three inches in diameter, made their appearance. These were at first of a snowy whiteness, cottony, and dense, just like large tufts of cotton-wool, of considerable expansion but of miniature elevation. They projected from the paper about a quarter of an inch. In the course of a few weeks the color of the tufts became less pure, tinged with an ochraceous hue, and resembling wool rather than cotton, less beautiful to the eye or a lens, and more entangled. Soon after this, darker patches made their appearance, smaller, dark olive, and mixed with, or close to, the woolly tufts; and ultimately similar spots of a dendritic character either succeeded the olive patches, or were independently formed. Finally, little black balls, like small pinheads, or grains of gunpowder, were found scattered about the damp spots. All this mouldy forest was more than six months under constant observation, and, during this period, was held sacred from the disturbing influences of the housemaid's broom, being consigned to the master's care with little compunction, but occasionally it became the subject of remarks not altogether flattering either to the wall or the moulds, or the master who was protector and patron of such a wretched mess.

Curiosity prompted us from the first to submit the mouldy denizens of the wall to the microscope, and this curiosity was increased week by week, on finding that none of the forms found vegetating on nearly two square yards of damp wall could be recognized as agreeing specifically with any described moulds with

which we were acquainted. Here was a problem to be solved under the most favorable conditions, a forest of mould indoors, within a few yards of the fireside, growing quite naturally, and all strangers; could they all be related, or if not, why should all of them appear on that wall for the first time? Whence could these new forms proceed? Were they a new creation? Were they only other conditions of very common things? Certainly here was material for much reflection, perhaps some speculation. Some of the problems are still unsolved.

Fig. 78.



a, Barren thread of *Rhinotrichum lanosum*; *b*, Fertile thread; *c*, Portion of fertile thread, showing one of the branchlets with terminal spicules bearing the spores; *d*, a spore detached.

The cottony tufts of white mould which were the first to appear had an abundant mycelium, but the erect threads which sprung from this were all for some time sterile (Fig. 78, *a*); they were slender, very delicate, jointed, and branched; so interlaced that it was difficult to trace the threads throughout their length, or to separate them from each other. Fertile threads were then developed in tufts mixed with the sterile threads, or individual fertile threads appeared amongst the sterile. These latter were rather shorter and stouter, also sparingly branched, but beset throughout nearly their whole length with short, patent, alternate (mostly) branchlets. The branchlets were broadest towards the apex, so as to be almost clavate, and the extremity was beset with two or three short spicules (Fig. 78. *b*). Each spicule was surmounted by an obovate spore (Fig. 78, *d*) attached to the spicule by its smallest end (Fig. 78, *c*). The presence of fertile threads gave the pale ochraceous tint to the tufts already alluded to. This tint was so slight that perhaps it would have passed unnoticed but for the proximity of the snow-white tufts of barren threads. The fertile

flocci, it may be from the weight of the spores, were decumbent, hence the fertile tufts were not much elevated above the surface of the matrix.

This is a most interesting mould belonging to the order of *Mucedines*, but it seemed to agree so little with the characters of any known genus, that, on distributing specimens last year, it was placed provisionally in a new genus under the name of *Clinotrichum lanosum*;* since then, with the advice of some mycological friends, it has been referred to the old genus Rhinotrichum, as *Rhinotrichum lanosum*. Without entering here upon the reasons which led to this course, or attempting to discuss generic and specific distinctions, it is sufficient to indicate that the mould in question possessed such positive characters, and was so different from all recognized forms, that it not only had claims to be regarded as a distinct species, but it still remains doubtful whether it should not constitute the type of a new genus.

The mould above described having become established for a week or two, small blackish spots made their appearance on the paper, sometimes amongst thin patches of the mould and sometimes outside them. These spots, at first cloudy and indefinite, varied in size, but were usually less than a quarter of an inch in diameter. The varnish of the paper was afterwards pushed off in little translucent flakes or scales, an erect olivaceous mould appeared, and the patches extended to nearly an inch in diameter, maintaining an almost universal circular form.

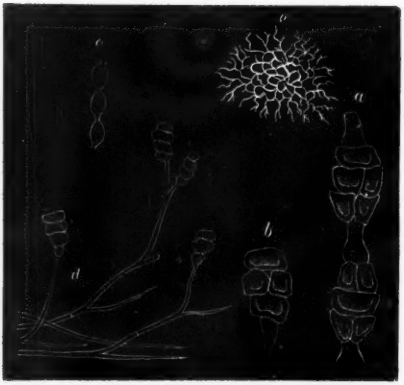
This new mould sometimes possessed a dirty reddish tint, but was commonly dark olive. There could be no mistake about the genus to which this mould belonged; it had all the essential characters of Penicillium: erect jointed threads, branched in the upper portion in a fasciculate manner, and bearing long beaded threads of spores, which formed a tassel-like head, at the apex of each fertile thread (Fig. 76). For the benefit of the mycologist, we may observe that, although at first reminded of the *Penicillium olivaceum* of Corda by the color of this species, it differs in the spores being oblong (Fig. 76, *a*), instead of globose, and the ramifications of the flocci are different. Unable again to find a de-

*CLINOTRICHUM, *gen. nov.* Hyphasma creeping; fertile flocci septate, decumbent, simple, or branched; branchlets alternate, patent, short, bearing at their tips a few spores attached to short spicules; spores simple. Type, *Clinotrichum lanosum*.—Cooke, *Fungi Brit. Exs.* No. 356.

scribed species of Penicillium with which this new mould would agree, it was named *Penicillium chartarum*.

Almost simultaneously, or but shortly after the perfection of the spores of the Penicillium, other and very similar patches appeared, distinguished by the naked eye more particularly by their dendritic form (Fig. 79, *e*). This peculiarity seemed to result from the dwarfed habit of the third fungus, since the varnish, though cracked and raised, was not cast off, but remained in small angular fragments, giving to the spots their dendritic appearance, the dark spores of the fungus protruding through the fissures. This same mould was also found in many cases growing in the same spots amongst *Penicillium chartarum*, but whether from the same mycelium could not be determined.

Fig. 79.



a, Part of chain of spores of *Alternaria chartarum* of Preuss; *b*, spores of *Sporidesmium alternaria*; *c*, supposed early condition of spores of the same; *d*, mode of growth of *Sporidesmium alternaria*, showing mycelium with erect threads and spores; *e*, dendritic patch of *Sporidesmium alternaria*, natural size, showing its habit.

The distinguishing features of this fungus consist in an extensive mycelium of delicate threads, from which arise numerous erect branches, bearing at the apex dark brown opaque spores. Sometimes the branches are again shortly branched, but in the majority of instances are single. The spores are septate, sometimes with two, three, or four divisions, many of them again divided by cross septa in the longitudinal direction of the spore, so as to give a muriform appearance. As far as the structure and appearance of the spores are concerned, they are very similar to those of *Sporidesmium polymorphum;* consequently specimens were published as a variety of that species, but the accuracy of this determination is open to very grave doubts. The mycelium and erect threads are much too highly developed for a good species of Sporidesmium, and certainly so for the species to which they were referred, so that in the "Handbook of British

Fungi" it is named *Sporidesmium alternaria*, for reasons hereafter detailed (Fig. 79, *d*).

Preuss has described, in "Sturm's Flora," a species of Alternaria in which the spores are attached end to end in a beaded manner, as in other species of that genus, and the spores themselves are just of the character of the spores of our Sporidesmium, as will be seen by reference to, and comparison of, Figs. 79, *a* and *b*.

Preuss's Alternaria, which he calls *A. chartarum*, was also developed on paper, and it is not improbable that it is a more highly perfected form of the Sporidesmium in question. This view is strengthened by the appearance of freshly collected specimens of the Sporidesmium, in which, as seen by a half-inch objective, the spores seem to be moniliform; but if so, the attachment is so slight that all attempts to see them so connected when separated from the matrix have failed. On one occasion a very immature condition of the Sporidesmium was examined, containing simple beaded spores (Fig. 79, *c*), connected by a short neck. There is therefore some foundation for believing that the spores of this species are at first hyaline, simple, and connected together in a moniliform manner by a short apiculus; but, as subsequent search did not reveal any further corroborative evidence, it can only be considered probable. Finally, Mr. C. E. Broome, to whom specimens of the Sporidesmium were submitted, confirmed the observation that, when seen *in situ*, the spores seemed to be beaded.

The last production which made its appearance on our wall-paper burst through the varnish as little black spheres like grains of gunpowder. At first the varnish was elevated by pressure from beneath, then the film was broken, and the little blackish spheres appeared. These were, in the majority of instances, gregarious, but occasionally a few of the spheres appeared singly, or only two or three together. As the whole surface of the damp paper was covered by these different fungi, it was scarcely possible to regard any of them as isolated, or to declare that one was not connected with the mycelium of the others. The little spheres, when the paper was torn from the wall, were also growing from the under surface, flattened considerably by the pressure. We shall call this species, for the sake of distinction, *Sphæria cyclospora*. The spherical bodies, or perithecia, were seated on a plentiful colorless mycelium. The walls of the perithecia, rather more carbona-

ceous than membranaceous, are reticulated, bringing to mind the same structure in Erysiphe, to which the perithecia bear considerable resemblance. The ostiolum is so obscure that we could not be satisfied of its existence, or whether the perithecia are ruptured when mature. It is rather from analogy than positive evidence that the name of Sphæria is given (Fig. 80, *a*). The interior of the perithecia is occupied by a gelatinous substance consisting of long cylindrical sacs or asci, each containing eight globose, colorless sporidia (Fig. 80, *b*). These are accompanied by slender branched threads, called paraphyses, supposed to be abortive asci. At first, and for some time, the perithecia contain only a granular mass, at length mixed with paraphyses. The contents of the fertile asci are also at the first granular, and finally the sporidia are perfected.

Fig. 80.

a, Perithecium of *Sphæria cyclospora*; *b*, ascus with sporidia and paraphysis.

We have now described, as fully as seemed to be necessary, the four forms of fungi which vegetated during last winter and spring on our damp wall. What presumption have we that they belong to one and the same fungus — direct evidence there is none — or should they be regarded each as autonomous? We have already intimated the difficulties which beset all attempts to obtain positive evidence in such cases. Already too many theories have been based on, or supported by, supposed results from the cultivation of fungi spores. Many ridiculous assertions have been made by those who have thus exhibited their thorough ignorance of even generic distinctions, to say nothing of more complex relations in mycologic science. Still we are by no means prepared to doubt that many of the recorded cases of polymorphism will ultimately be proved to be fact, and that many more will yet be discovered. We would admit that it is possible that none of the species, now included in the two great families of *Coniomycetes* and *Hyphomycetes* are autonomous. But, because it is *possible*, it by no means follows that we are prepared to condemn them by wholesale, or to admit that there is at present any evidence for doubting the autonomy of some entire genera. In the present condition of the study, and in the face of some startling facts, it is important that

all observations should be recorded which bear upon the subject of polymorphism, whilst great care ought to be exercised in the declaration of positive judgment.

Reviewing the instances of association above recorded, and we should prefer, for the present, calling them *association* only, the mind naturally reverts to other and similar recorded instances. Supposing the whole of the four forms described above to be conditions of *Sphæria cyclospora*, there is no greater faith needed to believe it true than in the case of *Sphæria herbarum*. If *Alternaria tenuis* is really a condition of a Sphæria, why not *Alternaria chartarum?* If Alternaria be associated with Cladosporium, why not with Penicillium? Or if *Sporidesmium epochnum*, why not *Sporidesmium polymorphum?* And as for Rhinotrichum and Penicillium, it is just as possible for these to be polymorphic, as for Dactylium, Dendryphium and Verticillium. When the presumption is confirmed by repetition, and more positive relations, there can be no doubt of a much more ready acceptance of their polymorphism than there would have been prior to the investigations of the Messrs. Tulasne and De Bary.

We are unable, within the limits prescribed for this article to explain the relations which subsist between such fungi as the "red-rust" and "mildew" of corn, and the barberry "cluster-cups;" or between the "yellow rust" and the "black brand" of the bramble and rose. In other words, the polymorphism of the *Uredines* and their allies. This is less to be regretted, since there has not, during the past four or five years, been any important additions to our knowledge on this subject and what had previously been discovered and illustrated is very generally known.

If we are asked what deductions we are to make from the facts proved and the presumptions admitted, but not proven, we may answer briefly—that the tendency of recent discoveries, in the relations of one form to another amongst fungi, is to demonstrate that reproduction is not so simple a process in these low conditions of plant life as had hitherto been supposed. "This it is and nothing more."

At one time the word "spore" represented the only recognized organ associated with the multiplication of fungi. Male organs or fecundative power was now and then mysteriously alluded to, but until recently all reproduction was supposed to be confined to a kind of germinative bud which was termed a spore. Each fungus was held to be perfect in itself, and reproduced itself, with

no relation to any other individual, by this means. The change of opinion amongst mycologists is manifested, as much as anything, in the new terms, or the appropriation of terms from other cryptogams, now in vogue. Conidia, spermatia, oospores, zoospores, pycnidia, protospores, etc., all relate to organs but recently recognized in fungi. And however much we may qualify the fact, however much we may doubt the evidence in special cases, we cannot ignore the conclusion that reproduction is very complicated, although very little understood in these extraordinary plants. Whilst admitting that the Cladosporium and the Macrosporium, the Alternaria, bottle-shaped cysts, and minute spermatia are all so intimately related with a certain species of Sphæria, that they can no longer be regarded as plants with a distinct autonomy and independent existence, we are unable to explain the relations which one bears to the other, or by what means each exerts its influence. The field for observation and research is a large one and promises a rich reward; all that is required is earnest and careful workers, in which *this*, of all European countries professing to be scientific, has hitherto been most lamentably deficient. How long shall such a reproach continue?—*Popular Science Review.*

REVIEWS.

Inland Fisheries.—The Report of the Massachusetts Commissioners * contains many items of encouragement for those who advocate restocking our rivers with salmon, trout, shad, alewives, bass, etc. Indeed the great run of shad in the Connecticut in the spring of 1870, has been by popular voice attributed to the artificial hatching of the fish in that river in 1867,—undoubtedly aided, however, by the law prohibiting the small mesh of the nets formerly used, which, being only two and a half inches, caught the fish of one and two years of age and of course at once diminished the catch of large fish. Under the new regulation a mesh of not less than five inches is allowed, and thus only the full

*Fifth Annual Report of the Commissioners on Inland Fisheries. 8vo pamph. pp. 77. January, 1871. State Document.

grown three year old fish can be caught in any number. The close time of thirty-six hours (it ought to be forty-eight), in each week will give these fish a chance to spawn up the river, now that the fish ways are open, and we congratulate our Connecticut fishermen on the good days that are before them, owing to the affection of "Green's shad" (as they have been called, as Mr. Green was the person who stocked the river in 1867) for their place of birth.

Many thousand young fry of the salmon, St. Croix salmon, Sebago salmon, togue and common trout have been placed in the rivers and ponds of Massachusetts and adjoining states during the past year, and we confidently expect to live to see good salmon and trout again abundant in our waters.

Much of the present report is taken up with the work of the Commissioners in bringing the owners of the Holyoke Water Co. to realize the fact that the fishes have a legal as well as natural right to a free passage in our rivers, and the Supreme Court having decided in favor of the fishes we trust that this case will settle all opposition to fish ways, which, as the commissioners state, the owners of dams are fast discovering, practically take little or nothing from their water power.

An account of the breeding and habits of the Black Bass by the late Mr. Tisdale (which we reprinted in our last number), and the valuable remarks made by Capt. Atwood, the veteran fisherman and Senator, on the habits and modes of capture of our sea fishes, conclude this very satisfactory report.

Mr. Atkins in his report as Commissioner of Fisheries of the State of Maine* enters very fully into the subject of fish ways, and in a most practical and common sense manner tells us what has been done, and still better, of the decided success of all the fish ways that were completed in time for the fish ascending during the season of 1870. From this report it can no longer be a matter of doubt but that properly constructed fish ways can be made at no very great cost, which not only will furnish a free passage to the fish, but also without materially injuring the water power of the parties owning the dams. Now that these points are secured practically, we shall hear but little about the "theory" regarding fish ways. Their construction on every salmon, shad and alewife

*Fourth Report of the Commissioner of Fisheries of the State of Maine, for the year 1870. 8vo pamph. pp. 56. 2 plates. State Document. 1870.

river and stream in the country is now only a matter of time, for as it is proved that their construction is now simply a matter of dollars and cents, and also that the interest received by the community is very large on the small capital required to be invested, the most penurious of dam owners will be forced by public sentiment to keep the fish ways, which the laws oblige them to build, in good repair.

Mr. Atkins also enters into the question of "close time" and shows that far better results would be attained by giving up the close time at the mouths of rivers and substituting a law regulating the depth of seines and pounds, thus allowing a portion of the fishes a chance to escape the nets and ascend the river. As it is impossible to enforce the present law without breaking up the fisheries, this proposed change seems to us a very wise and practical way of aiding the unjustly treated fishes in their eternal "struggle for existence."

An appendix to the Report gives an account of the fish breeding establishment of the Canadian Government, situated on Wilmot's Creek and under the charge of Mr. Samuel Wilmot. The two plates illustrating the various plans of fish ways in use in this country and in Ireland, will be found of much practical benefit to persons engaged in their construction.

Mr. Robert B. Roosevelt, who, of the three commissioners, seems to be the "writing man," assisted by Mr. Seth Green, who is preëminently the practical "fish breeder" of the United States, has given an interesting report of the work accomplished by the New York Commissioners during 1870. *

Mr. Green was sent up the Hudson in May, for the purpose of obtaining shad spawn for stocking the river above the Troy dam, but owing to there being no "close time" on this river, and the consequent capture of about all the shad at its mouth, Mr. Green only succeeded in obtaining a few ripe fish (many days not getting any, and the best day's fishing only brought him twelve). From what he did get he hatched out and put in the river about two and a half million of young fry, or "more than double the entire yearly yield of shad on the whole river." As a commentary on the condition in which Mr. Green found things on the Hudson, he simply states that unless a weekly close time of one or two days

* Report of the Commissioners of Fisheries of the State of New York, for the year ending Dec. 31, 1870. 8vo pamph. pp. 32. State Document. 1871.

is enforced a net might as well be stretched entirely across the river and the fishery declared extinct. In which we think he is about right, for what use will it be to restock the rivers unless we have laws prohibiting excessive fishing, either by allowing the fish an unobstructed passage up the river for one or two days each week, or by not allowing the use of anything smaller than five inch mesh, and limiting the depth of all set nets, as proposed by Mr. Atkins.

During the year a large state hatching house was erected at Caledonia and placed under the charge of Messrs. Green and Collins, who very successfully carried out a number of experiments and hatched a large number of fish of various kinds. The attempt was made to hatch the spawn of the pike perch (Lucioperca) of Lake Ontario, but with little success, owing to the eggs being surrounded by a sticky substance and adhering so firmly together and to the sides of the pans as to prevent their being detached without destroying them. By constantly stirring the eggs for forty minutes after impregnation, Mr. Green succeeded in hatching a few. In a natural state he thinks the eggs are scattered as laid and adhere singly to the gravel, etc.

The experiment was tried of impregnating the eggs of the salmon trout with the milt of the white fish, and the eggs were hatched, bringing forth hybrids that have characters of both parents, which, at the time of writing the report, were thriving well. These fish will probably grow to good size, and may prove a very acceptable table fish, but it is hardly probable that they will be capable of continuing the race, as they are generic and not specific hybrids.

The Commissioners have hit upon the following expedient for obtaining young black bass and several other (they write it *hundreds*) species of fresh water fishes.

"Although no means of hatching black bass and hundreds of other species has yet been discovered, another method was found for reaching substantially the same end. Every year large numbers of various kinds of bass and other fresh water fish pass into various State canals, either when they are very young, or else they spawn there and raise their young, which attain the size of four to six inches during the summer and by the fall, when the canals have to be drawn off preparatory to the cold weather.

Heretofore, when the latter event occurred, the larger fish were taken from the holes and indentations in the bottom by the fisher-

men, with their nets, and sent to market, while the smaller fry were left to perish on the shore, or, when the holes dried up, to be frozen to death by the increasing severity of the winter.

Instead of permitting this terrible waste of valuable material, the commissioners made arrangements for saving a greater part of these little fish, and for distributing them throughout the waters of this State, whenever they are needed or can be used to advantage. In this way they have reached what bids fair to be an inexhaustible supply of fish that have heretofore defied the breeders' art."

This grand supply ground has been, by vote of the Canal Commissioners, placed entirely at the disposal of the Fish Commissioners.

The Fish Commissioners have also received authority from the Park Commissioners to use the ponds in Central Park for the purpose of experimenting on foreign fresh water fishes with the hope of introducing valuable species to this country. With this end in view they have started the experiment with the carp, so extensively used for food in Europe, Mr. Frank Buckland, the English Fish Commissioner, having promised his services. Mr. Roosevelt's letter to Mr. Buckland, however, shows that the New York Commissioners are not very well informed as to American ichthyology, as the following extract will exhibit.

"The carp of all the eastern waters of America is a small, comparatively worthless fish, while the western carp is little known, its habitat not being even established, and it has never been described scientifically. In fact, if I had not seen it personally, I might almost doubt its existence. The European fish, on the contrary, is a large, fine fish, as we are informed, and will probably bear transportation as easily as the gold fish, which, as you know, is a similar species."

Perhaps in the next report we shall be informed *what* species of fishes are intended under the names of the *carp of all the eastern waters*, and the little known *western carp* that has *never been described scientifically!* As there are no species of the true carp genera (*Cyprinus** and *Carassius*) indigenous to North America,

*There are two distinct species of fishes known as "Carp" in Europe. The true carp, *Cyprinus carpio* Linn., which is a native of Asia and was *introduced* to Europe, has always been kept in a more or less domesticated condition, producing several varieties and hybrids. This is the carp, or Cyprinus, of the early writers. The other species is the *Carassius vulgaris*, the *Cyprinus carassius* of Linnæus. This species is called the "Crucian" or Crucian Carp, etc., and is a native of temperate Europe and Asia, and very extensively domesticated and employed for food. Its close ally is the Gold fish or Golden carp, *Carassius auratus*, which has been introduced from China and domesticated in all civilized countries.

and as the Western fishes usually called carp belong to the sucker family and are pretty well known to ichthyologists, we are somewhat surprised at the broad statement made by Mr. Roosevelt to the contrary. Then the Commissioners seem to be quite neglectful in not looking up the stock of carp which, according to a letter published in DeKay's "Fishes of New York" (p. 189), were introduced in 1831 and '32 by Henry Robinson, Esq., of Newburgh, Orange Co., N. Y. Mr. Robinson states that he put some six or seven dozen carp, which he brought from France, into his ponds, and that "they increased to a superior degree" and (in 1841) he had "more than sufficient for family use." It is hardly possible that the Robinson fish could have become exterminated, as they seem to have thrived well, and Mr. Robinson also states in his letter that "For the last four years past, I have put from one to two dozen carp every spring in the Hudson river near my residence. They have increased so much that our fishermen frequently take them in their nets. They are larger than those in my ponds." In "Frank Forester's Fish and Fishing" (1851) p. 166 an account of these carp is given, and mention made of a law of the state protecting them for five years, etc. This is certainly a matter worth looking into by the State Commissioners.

The Report closes with several characteristic letters from Mr. Green.

The May Flies.*—This elaborate work is of use to entomologists generally as it gives a list, with brief descriptions, of many foreign species, and hence will be of much use in America. It will evidently prove, when completed, to be the standard work on this interesting family, and with its excellent plates, full synonomy and many critical notes, is a great step in advance of any paper yet published on this group. The author finds that the study of alcoholic specimens is absolutely necessary for characterizing the species, as the bodies shrivel in drying. We hope the students of other groups of delicate-bodied insects will follow Mr. Eaton's excellent example, and that insects preserved in alcohol will be found in all our entomological collections.

The number of described recent species of this family is about one hundred and seventy-eight, of which fifty-three are found in

*A Monograph on the Ephemeridæ. By the Rev. A. E. Eaton. Part I. The Nomenclature of the Ephemeridæ. (From the Transactions of the Entomological Society of London, 1871.) 8vo. pp. 164, with six plates.

the United States and British North America. There are three fossil species determinable, the oldest being from the Oolite formation at Solenhofen. The author gives a list of species of fossil insects which have been at various times and by different observers referred to this family. They are from formations older than the Tertiary, mostly the Carboniferous. Among them are the strange forms described as Dictyoneura, Eugereon, Miamia, Hemeristia, Haphlophlebium, Platephemera, Homothetus, Xenoneura, Gerephemera and Lithentomum. He says that "Platephemera and Homothetus may possibly be of the Ephemeridæ, but there is nothing in the figures to make this certain, and there is no reason for considering that Xenoneura belongs to this family." He then remarks: —

"Palæontologists have adopted a ridiculous course with regard to some insect fossils. Whenever an obscure fragment of a well-reticulated insect's wing is found in a rock, a genus is straightway set up, and the fossil named as a new *species*. The species is then referred to the Ephemeridæ, and is immediately pronounced to be a synthetic type of insects, at present distantly related to one another in organization. This enunciation of synthetic types is often nothing less than a resort to random conjecture respecting the affinities of animals which the writer is at a loss to classify. An insect allied to the Ephemeridæ which chirped like a Locust (such as Xenoneura is imagined to have been) is a tolerable sample of these synthetic types. When a fossil comprises only a fragment, or even a complete wing of an Ephemerid, it is hardly possible to determine the *genus*, and impossible to assert the *species*. The utmost that can be learned from such a specimen is the approximate relations of the insect. Neuration by itself is not sufficient to define the species or even the genera of recent Ephemeridæ.

This criticism on the labors of palæontologists seems to us, considering the great difficulties of the subject they have to deal with, scarcely fair, though perhaps in part deserved. That synthetic, or comprehensive, or generalized types exist among the vertebrates, as for instance the Archæopteryx, the pterodactyles, the palæozoic fishes; and others among the radiates and molluscs, our critic would not probably deny. And among the palæozoic insects, genera such as Eugereon, Dictyoneura, and Palephemera, are not considered as generalized types simply as a device of the puzzled and distracted entomologist for a means of escape from coming to any decision. These "random conjectures" are, if such, due to the

singularly comprehensive character of many of the fossil remains of Carboniferous and Devonian times; and it is by the study of these fragments of wings that we are gradually coming to a better knowledge of the links uniting the families of the Neuroptera (in the Linnæan sense) and that the great differences in opinion between entomologists regarding the classification and position in nature of the Orthoptera and Neuroptera are to be settled. We would inquire what would recent zoology be without the "obscure fragments" left us of Palæozoic life? The inference forced upon us from their study is that the earlier forms of life were more generalized than now, and thus, in all probability, were the primitive stock or ancestral forms, which have been by evolution differentiated into the forms now living.

We would inquire also whether one is not safe, or whether it would not be safer in practice, to consider a fragment of a Palæozoic, or earlier Mesozoic insect's wing as belonging to a different species or genus from any now living, if the fragment does actually differ from corresponding portions of any living species with which it may be compared?

We quote the following useful remarks on the preservation of these insects for study. "In drying, the color and form of Ephemeridæ soon change. Color is of little importance, even in fresh examples; but form is necessary to the distinguishing of the species. They are, therefore, best preserved in a liquid. It is sufficient for ordinary purposes to dip the freshly killed specimen into dilute spirits, and then transfer it to a tube, or homœopathic globule bottle, partly filled with water. Next, Price's glycerine is added to the water—one or two drops a day—until the bottle is gradually filled. A small drop of acetic acid may be added finally, to prevent the growth of mould. The name of the species may be written on the disk of the cork, the date and locality of capture round its side. Hind-wings of the species of Baetis and Centroptilum should be mounted on slips of grass, for microscopical examination. Pinned specimens are often difficult to determine, in consequence of their shrinking; to card them is to render them fit for nothing."

Why does our author always call the larva a "nymph?" Does not this term apply to the pupa alone? The remarks on the principal points to be studied in the young and adult of these insects are capital.

ARRANGEMENT OF THE FAMILIES OF MOLLUSKS.* — This list of the families, orders and classes of mollusks, "prepared at the request of the Smithsonian Institution, for the purpose of facilitating the arrangement and classification of the mollusks and shells of the National Museum" is an exceedingly useful one, and every conchologist will find it indispensable in arranging his specimens. Dr. Gill states in the introduction, that "it must be considered simply as a provisional list, embracing the results of the most recent and approved researches into the systematic relations and anatomy of those animals, but from which, innovations and peculiar views, affecting materially the classification, have been excluded."

Those who have attempted the compilation even of a list of the groups of a class or higher division, know well enough the difficulties attending its preparation, and our author has not attempted it without giving the result of researches covering a number of years. He is assisted in some groups by Mr. Dall. Dr. Gill admits the division of the mollusks into two primary groups, the *Mollusca vera* and *Molluscoidea*, the latter embracing the Brachiopoda and Polyzoa.

Now that several continental zoologists, among them Leuckart and Gegenbaur, have placed the Polyzoa among the worms, and Prof. Morse has considered the Brachiopods as a division of Annelids, a change alluded to by Dr. Gill, the time may come when these two classes will not be mentioned in conchological works.

But as it will be long before such revolutionary views, should they prove correct, will be adopted, it is most expedient in such an arrangement as this to let them go under the provisional name of Molluscoidea.

Malacologists will be interested in the remarks on the different groups, the classes, orders, etc., containing as they do many valuable suggestions as to the general classification of the subkingdom. We trust that similar lists will be prepared by specialists in other departments, and published by the Smithsonian Institution.

ASYMMETRY IN INSECTS.† — While many of the molluscs are fair examples of asymmetrical animals, as seen in the shells as well as

* Arrangement of the Families of Mollusks. By Theodore Gill, M. D. Smithsonian Miscellaneous Collections. 227. Washington, D. C. Feb. 8, 1871. 8vo. pp. 65.

† On Asymmetry in the Appendages of Hexapod Insects. By S. H. Scudder and E. Burgess. (From the Proceedings of the Boston Society of Natural History.) 1871. 8vo, pp. 24, with a plate.

the bodies of these animals, and while in most of the radiates it is difficult to detect any line dividing their body into halves, the insects, and indeed all the articulates, are as a rule symmetrical, one-half of the body, together with its appendages, exactly repeating the opposite. As our authors remark, however, some of the Crustacea are asymmetrically developed, and they give as examples, the entire body of Bopyrus and Peltogaster, low parasitic forms, and the claws of many Decapods, such as the lobster and many species of shrimps. They further remark: —

"We are not aware that any cases of asymmetry have been recorded among the worms; and certainly very few among insects; there are occasionally slight differences in the right and left mandibles of some mandibulates [such as beetles], and Coccus has recently been referred to by Gerstaecker as an example of asymmetry, without further specification; we have been unable to discover to what he refers. Loew, also, in the first of his monographs of the North American Diptera, states that the hypopygium (the external genital armature) of the males of Syrphidæ and Pipunculidæ is unsymmetrical."

A figure of this organ, belonging to a species of fly, Phora, is given in illustration, with the left clasp very much stouter and somewhat longer than the right one.

In studying the external genital organs of the males of Nisoniades, a genus of butterflies belonging to the skippers, a most remarkable asymmetry was detected between the opposite clasps of the same individual. This is found more or less marked in all the species yet known, the left clasp "with some minor exceptions," being always more highly developed than the right.

It is difficult to account for this asymmetry. The males are much more numerous than the other sex, and the authors are inclined to think that "the excessive development of these parts in the male, is in correlation with their superior numbers, ensuring beyond doubt, the impregnation of every female; we do not, however, see how asymmetry gives any superior advantage." A description of these parts in the different species follows, and eleven new species are described. It is a pity that other than these secondary sexual characters were not added for the better discrimination of the species of so large and difficult a genus — but further descriptions of the new forms are probably reserved for another occasion.

RECORD OF AMERICAN ENTOMOLOGY FOR 1870.*—This useful index to our entomological literature published during the year 1870, forms a much thinner pamphlet than its predecessors. We are not, however, to infer from this that entomology is on the decline in this country, as we must expect some variation from year to year in the degree of attention to this study. The number of entomologists who have published articles of varying length is thirty-five, while three hundred and one new species of insects have been described in American journals during the year. We hope entomologists will continue as before to give this enterprise a cordial support, as the "Record" is by no means self supporting. Public libraries should have these annual records, as they are valuable for reference and relate to a large and growing department of zoology.

NEW ORNITHOLOGICAL WORKS.—A new edition, the fourth, of "Yarrell's History of British Birds," is now in course of publication by Van Voorst, under the editorship of Prof. Alfred Newton, the well known ornithologist, and Professor of Zoology in the University of Cambridge. The work is issued in monthly parts of eighty pages each, at 2*s* 6*d* a part. It is expected that twenty-five parts will complete the work, which will be comprised in three octavo volumes containing nearly six hundred illustrations. The names used by Yarrell in the former editions will be retained, but at the same time the nomenclature will be brought up to the present requirements of ornithological science, and all birds that have been found to be inhabitants of the British Isles since the time of Yarrell will be given.

A much larger and more pretentious work is the "History of the Birds of Europe, including all the species inhabiting the Western Palæarctic region," by R. B. Sharpe and H. E. Dresser.

This work, of which two parts are now ready for delivery, is to be issued in monthly parts of quarto size with colored plates. All the birds of Europe, amounting to about six hundred species, will be figured in their different stages of plumage, a plate being devoted to each species. Each annual volume will contain one hundred plates, with full descriptions of the species and remarks on the habits, geographical distribution, synonymy, etc.

The unrivalled facilities at the command of the authors, and the

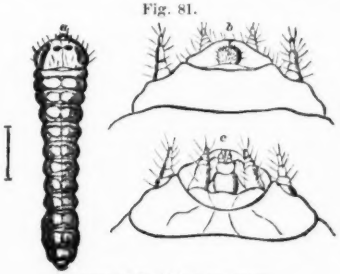
*Published by the Naturalists' Agency, 1871. 8vo. pp. 27. Price 50 cents. The Records for 1868, '69 and '70 for $1. 50.

assistance guaranteed them by all the leading ornithologists of Europe, with the support of a good list of subscribers, will make the work a decided success in every way. Both the authors are well known as practical field naturalists, and the successful manner in which Mr. Sharpe has just completed his "Monograph of the Kingfishers" is sufficient evidence that the work will be carried through the press in the best manner possible.

As the work will hardly be accessible for the private libraries of most of the ornithologists of our country, owing to its necessarily high cost, it should have a place in all our large libraries, where those who cannot afford to own the work, can at least have a chance of consulting its pages: and as many of our birds are identical with those of Europe, and many others very closely allied, it will become the duty of every one engaged in the study of birds to consult this splendid monograph. The work is published by the authors, by special permission, at the office of the Zoological Society of London, where we should be pleased to forward the names of subscribers.

Economic Entomology in Massachusetts.*—This first report on the injurious and beneficial insects of Massachusetts opens with some general remarks on the losses sustained by insects. In this country alone they are estimated at not far from five hundred

Fig. 81.



Larva of *Callidium amoenum*.

Fig. 82.

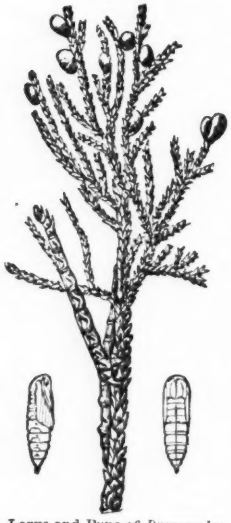
Drepanodes juniperaria.

million dollars annually, of which amount, at least one-tenth, or fifty millions, could probably be saved by human exertions, were

*First Annual Report on the Injurious and Beneficial Insects of Massachusetts. By A. S. Packard, jr., M. D. Entomologist to the State Board of Agriculture. Boston, 1871. 8vo. pp. 31. Extracted from the Annual Report of the Secretary of the Mass. Board of Agriculture, from which the illustrations here used were taken.

farmers made better acquainted with the habits of insects and the best means of combating them.

Fig. 83.



Larva and Pupa of *Drepanodes juniperaria.*

Then follows an account of the European saw-fly (*Nematus ventricosus*, fig. 88, larva, *a*, enlarged; 89, *a*, male; *b*, female) doing so much damage in the state. It is stated that June 29th the worms of the second brood were spinning their cocoons. It might be added that in the first and second weeks of August the worms were still on the bushes in Salem, and the females of the second brood were laying eggs for a third brood of worms. This destructive saw-fly is now pretty well distributed over New England. At Orono, Maine, early in July they were very destructive, and had been so the year previous. Another very destructive insect, the Rape caterpillar, *Pieris rapæ*, (Fig. 86, male; 87, female; 85 *a*, larva, *b*, chrysalis) which annually does two hundred and fifty thousand dollars worth of damage to the cabbage crop about Quebec alone, is now abundantly distributed over New England, and southward as far as New Jersey. During the last two years it has been common at Orono, Maine.

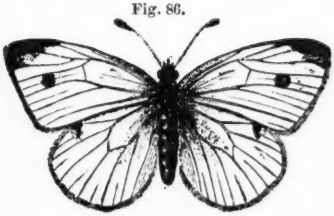
Fig. 84.

Cedar Bucculatrix.

Fig. 85.

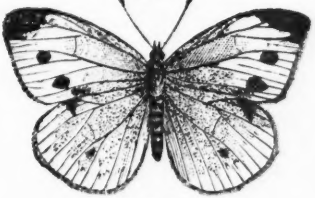
A new insect is described as infesting the limbs of the apple tree. It is the *Leiopus facetus* of Say (fig. 91). The larva can scarcely be distinguished from that of a species infesting the prickly ash, the *L. xanthoxyli* Shimer (Fig. 92 90 *a*, larva, *b* upper, and *c* under side of the head.) A somewhat similar borer which injures the grape vine is noticed. This is

Fig. 86.



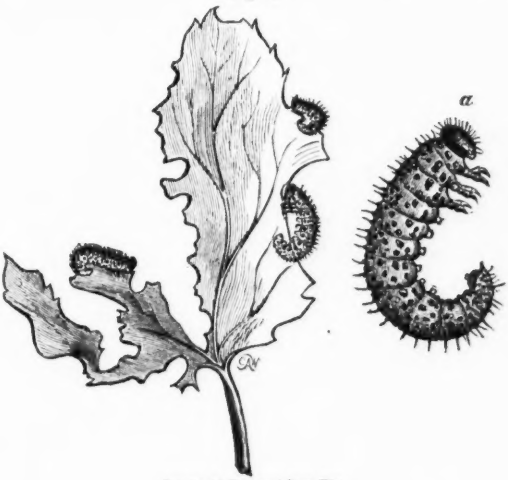
Rape Butterfly, male.

Fig. 87.



Rape Butterfly, female.

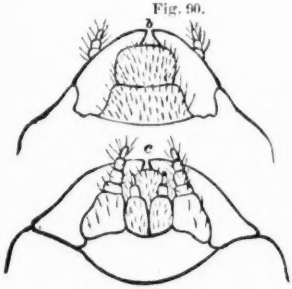
Fig. 88.



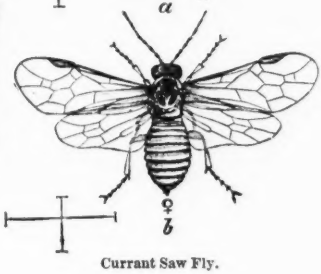
Larva of Currant Saw Fly.

Fig. 89.

Fig. 90.

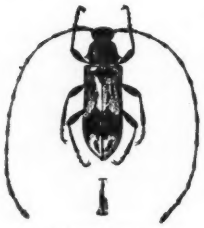


Larva of *Leiopus Xanthoxyli.*



Currant Saw Fly.

Fig. 91.



Leiopus facetus.

Fig. 92.

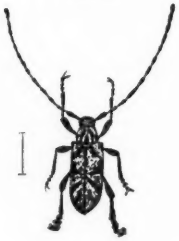
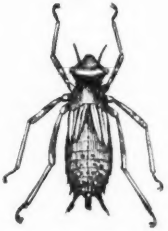
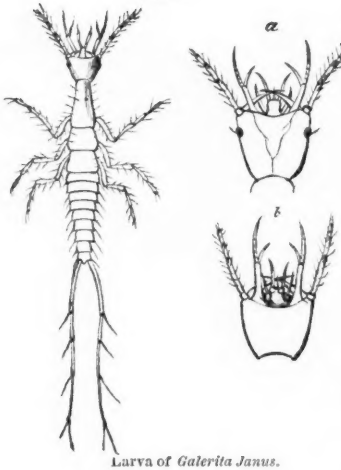


Fig. 93.



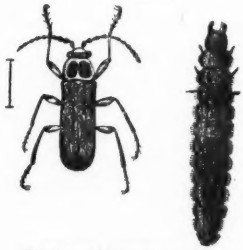
Larva of *Cordulia lateralis.*

Fig. 94.



Larva of *Galerita Janus.*

Fig. 96.

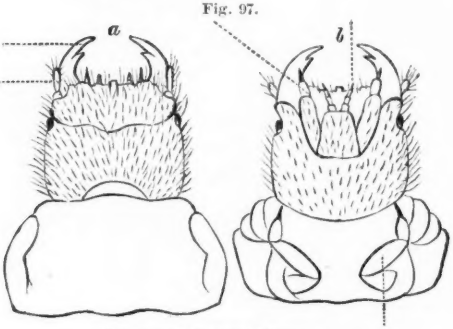


Telephorus bilineatus and larva.

Fig. 95.

Galerita Janus.

Fig. 97.



Larva of *Telephorus bilineatus.*

Fig. 98.

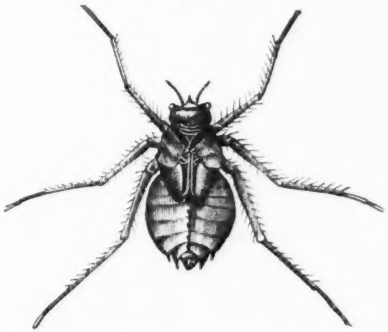
Callidium amœnum.

the *Callidium amœnum* Say (fig. 98). Its larva is represented by figure 81, *b*, upper, *c*, under side of the head.

One of the most wonderful cases of mimicry is that of a new span worm *Drepanodes juniperaria* Pack. (fig. 82; 83, larva and chrysalis) which can with difficulty be distinguished from the twigs of the juniper tree on which it feeds.

The cedar also has been found to be infested by a small Tinean, closely allied to the Apple Bucculatrix. This is described as the *B. thuiella* (fig. 84, enlarged; *a*, cocoon, nat. size). The transformations of *Telephorus bilineatus* Say (fig. 96; larva, enlarged, and adjoining fig. 97 showing *a*, upper, and *b*, under side of the head) are also described. The larva was identified by Mr. P. S. Sprague, who found it under stones in spring, where it changes to a pupa, and early in May becomes a beetle, when it eats the leaves of the birch.

Fig. 99.



Larva of Didymops?

Among beneficial insects are mentioned the ground beetle, *Galerita Janus* Fabr. (fig. 95) whose singular larva (fig. 94, *a*, upper, *b*, under, side of the head), was discovered by Mr. J. H. Emerton under stones early in July. The larvæ of two dragon flies, *Cordulia lateralis* (fig. 93) and a species of Didymops? (fig. 99) are also noticed.

NATURAL HISTORY MISCELLANY.

BOTANY.

The Number of Plants and Animals.—The days of a Systema Naturæ, or single work containing a synopsis of the genera and species of organized beings, are long since passed away.

Even a Species Plantarum, now that their number at the lowest estimate exceeds one hundred thousand, has become almost hopeless. The last attempt, De Candolle's Prodromus, has been nearly forty years in progress, the first portion has become quite out of date, and all we can hope for is that it may be shortly completed for one of the three great classes of plants. Animals might have been more manageable were it not for the insects. Mammalia estimated at between two and three thousand living species, birds at about ten thousand, reptiles and amphibia under two thousand, fishes at about ten thousand, crustacea and arachnida rather above ten thousand, malacozoa about twenty thousand, vermes, actinozoa, and amorphozoa under six thousand, would each by themselves not impose too heavy a tax on the naturalist experienced in that special branch who should undertake a scientific classification and diagnosis of all known species. In one important branch, indeed, the fishes, this work has been most satisfactorily carried out in Dr. Günther's admirable Genera and Species of all known fishes published under the misleading title of "Catalogue of the Fishes in the British Museum," and recently completed by the issue of the eighth volume. The sound philosophical views expressed in his preface to that volume (which, by some strange inversion, bears a signature not his own) can be appreciated by us all, and zoologists are all agreed as to the care with which they have been worked out in the text. Insects are, however, the great stumbling-block of zoologists. The number of described species is estimated by Gerstaecker at above one hundred and sixty thousand, viz.: Coleoptera, ninety thousand; Hymenoptera, twenty-five thousand; Diptera, twenty-four thousand; Lepidoptera, twenty-two to twenty-four thousand. Mr. Bates thinks that, for the Coleoptera at least, this estimate is too high by one-third, but even with that deduction the number would exceed that of plants, and it is probable that the number of as yet undiscovered species in proportion to that of the described ones is far greater in the case of insects than of plants. We can therefore no longer hope for a Genera and Species of insects, the work of a single hand, or indeed guided by a single mind. The great division of labor, however, now prevalent among entomologists may procure it for us in detail, with one drawback only, that the smaller the portion of the great natural class of Arthropoda to which the entomologist confines his attention, the less he will be able to appreciate the significance of

distinctive characters, and the more prone he will be to multiply small genera—that is to enhance beyond their due value the races of the lowest grades—to the great inconvenience of the general naturalist who has to make use of the results of his labor.

A Genera Plantarum is still within the capabilities of a single botanist, although he must, of course, trust much to the observations of others, and it therefore cannot be so satisfactory as if he had examined every species himself. The last complete one was Endlicher's, the result of several years' assiduous labor, but now thirty years old. Dr. Hooker and myself commenced a new one, of which the first part was published in 1862, and which might have been brought nearly to a close by this time had we not both of us had so many other works on hand to deter us, although the researches necessary for these other works have proved of great assistance to the Genera. As it is, the part now nearly ready for press carries the work down to the end of the Compositæ, or about half through the Phænogamous plants. In regard to works of a still more general description, the exposition of the families or orders of plants, we have nothing of importance since Lindley's "Vegetable Kingdom," dated 1845, but republished with some additions and corrections in 1853, and Le Maout and Decaisne's "Traité Générale," mentioned in my address of 1868, and of which Mrs. Hooker is now preparing an English translation, under the supervision of Dr. Hooker. Dr. Baillon has also commenced a "Histoire des Plantes," containing a considerable number of useful original observations, and illustrated by excellent woodcuts, but as a general work, one portion is of too popular a character, and in some cases too diffuse to be of much use to science, and the generic character too technical for a popular work without any contrasted synopsis, and its great bulk in proportion to the information conveyed will always be a drawback. I cannot believe that the author can have been a party to the unblushing announcement of the French publisher, that it is to be completed in about eight volumes. If carried out on the plan of the first one, it must extend to four or five times that number. In Zoology, Bronn's most valuable "Klassen und Ordnungen der Thierreichs," continued after his death by Keferstein and others, which I mentioned in my address of 1866, has advanced but slowly. The Amorphozoa, Actinozoa, and Malacozoa, forming the first two volumes, were then completed, and Gerstaecker has since been proceeding with

the Arthropoda, commencing with the Crustacea for the third volume, of which only the general matter and the Cirripedia and Copepoda are as yet published, and three or four parts of a sixth volume for birds have been issued by Selenka, treating the anatomical and other matters in great detail. Another general work of merit, although on a smaller scale, has been proceeding as slowly. Of Carus and Gerstaecker's "Handbuch der Zoologie," the second volume, containing the Arthropoda, Malacozoa, and lower animals, had been already published in 1861, and to this was added in 1868 the first half of the Vertebrata for the first volume, with a promise that the remainder should appear in the autumn, but which promise has not yet been fulfilled. Among the other recently published systematic zoological handbooks of which I have memoranda as published in various Continental states, the most important are said to be Harting's, published at Kiel, in the Netherlands, of which up to 1870 only three volumes had appeared, containing the Crustacea, Vermes, Malacozoa, and lower animals; A. E. Holmgren's "Swedish Handbook;" Zoology, of which Mammalia were published in 1865, and Birds in 1868 to 1871; and Claus's "Grundzüge," and Troschel's "Handbook" (7th edition) for University Teaching in Germany. — BENTHAM, Annual Address to Linnean Society, published in *Nature*.

SPONTANEOUS DOUBLE FLOWER OF NYMPHÆA TUBEROSA. — Dr. E. M. Hale of Chicago sends a flower of the Western White Water-Lily, having apparently only the ordinary number of petals, but no stamens and pistil whatever. If cared for it is likely that the root would soon send up flowers with an increased number of petals, like a full double rose. Unfortunately this species lacks the perfume of N. odorata.

ZOOLOGY.

ORIGIN OF SPECIES. — Professor Hyatt alluded at a late meeting of the Boston Society of Natural History, to the color of the common Unios and Anodons as probably protective, and the well-known case of the Melaniæ of the Western rivers, which are hardly distinguishable to the unpractised eye, and to the peculiar and marked variations of the siluroid fishes of the same region, which

agree very closely with the ground on which they live. Professor Hyatt added that he by no means desired to indorse the Darwinian doctrine of natural selection. A belief in evolution and the derivation of all higher forms from lower and simple organisms, perhaps from inorganic matter itself, by means of secondary natural forces, is perfectly consistent with opposition to the Darwinian theory. According to this theory, new characteristics and therefore new kinds and species of animals arise by the survival of the fittest; as in a recent instance cited by the AMERICAN NATURALIST, where a new race of deer is supposed to be in course of formation in the Southern Adirondacks. In this case certain full-grown bucks about thirteen years ago were produced with short, stabbing horns like the young deer. These were thus enabled to drive away the branching-horned forms during the rutting season, and to leave a larger number of descendants. These and their descendants, in turn enjoying similar advantages, are, it is stated, gradually supplanting the branching-horned deer in this locality. The facts have been disputed, and need the confirmation of further observation and experience; but they form, perhaps, one of the best illustrations of the theory of natural selection ever recorded. Assuming, however, that it is true, and that a new species of deer is now being evolved in this region, what does natural selection really account for? It must account for the preservation and perpetuation of the branching-horned variety, as well as the rise of the straight-horned.

The Anoplotherium of the Eocene, which has always been considered by Owen and others as the probable ancestor of the *Cervidæ*, had no horns, even in the adults. The young deer, when it is born, has none and the process by which they are acquired takes place subsequently. The general characteristics of the deer antlers of the Miocene and Pliocene were simple, with only one tyne or prong like those of the young deer, and the palmate and extensively pronged were not brought out fully until the post-pliocene. To-day a decline seems to be taking place, since neither the reindeer, nor the moose equals the extinct Irish elk in the complexity and rise of its horns.

If Darwinism can account for the propagation of this new race, by the advantage which the short stabbing horns gives to the bucks, how could any branching antlers ever have arisen from the Miocene deer? In accordance with the theory of natural or

sexual selection the horns should have become longer and sharper, and have dropped their tynes, thus making them better weapons. The reverse has certainly occurred, and antlers developed of extraordinary size, cumbersome and useless in comparison with the short dagger-like horns of the Miocene deer. According to Darwin's latest modification, in his Descent of Man, the increase in the size would be accounted for by sexual selection; namely that the females would select the males having the largest horns, and thus the size of the horns would be increased by successive generations. If this be the explanation, how shall we account for the rise of the short-horned variety at the present time? Darwin quotes this instance as an example of natural and sexual selection, in his last book, "The Descent of Man," vol. ii. p. 243, Am. ed.

Presuming, however, that natural selection does account for the evolution of the branching horns, and also for the preservation and gradual increase in numbers of the present spike-horned buck, as it may be fairly assumed in many instances to act in the preservation and perpetuation of many characteristics, it neither does nor can account for the first appearance of horns, or the first appearance of a full-grown buck having the spike-horns. This inadequacy of the theory of natural selection to show us how characteristics arise has been repeatedly insisted upon by several authors. Professor Cope and himself, in two widely separated departments, among the Reptiles on the one hand, and the Mollusks on the other, have repeatedly pointed out the mode in which characteristics, races, species and genera have arisen. Several writers on the continent, and Mr. St. George Mivart, in his "Genesis of Species," have lately taken similar views. The latter continually alludes to the sudden rise of species or races, and gives an instance of the sudden appearance of the black-shouldered peacock. This variety, previously known in India as a separate species, speedily increased to the extinction of the original form. Here, as St. George Mivart points out, under different geographical influences, the same species has suddenly arisen in India and in England. Here are no slow changes similar to those perpetually cited by Darwin and Wallace, no gradual fading of one species into another, but a sudden evolution of a new distinct form.

Mivart, too, states that the view here advocated regards the whole organic world as arising and going forward in one harmonious development, similar to that which displays itself in the growth

and action of each separate individual organism, This apparently is the keynote of his book. This was the view advocated by the speaker, some four years previous in the Memoirs of the Society, in a paper written to establish the fact that all characteristics had arisen suddenly among the *ammonites* and *nautili* of past geological epochs. This paper was a short, preliminary statement of facts observed, and it did not excite his surprise that Mivart had overlooked it. He could not however help wondering at the absolute silence preserved with relation to the essay of Professor Cope of Philadelphia. This had been issued at about the same time and independently, but advocated nearly the same views as regarded the sudden production of characteristics among the Reptiles, and must have been well known to Professor Huxley, with whom Mivart seems to have taken council. This omission is by no means creditable to the author of a work written to refute such books as Darwin is in the habit of producing, and contrasts unfavorably with that writer's evident acquaintance with the essay alluded to above. This is shown most by the manner in which he is obliged to rest the proof of his assertion, that species arise suddenly, upon a number of isolated facts; whereas either Professor Cope's paper, or the speaker's, especially the former, would have furnished him with a number of reliable and serially connected illustrations of the quick evolution of species.

Parasites. — Prof. Van Beneden, as we have before noticed, has distinguished true parasites, which live *on* their host, from commensals, those which live merely *with* their host, the thieving impostor from the respectable lodger. In an admirable work on the "Fishes of the coasts of Belgium, their Commensals and Parasites" published by the Academy of Sciences of Brussels, he now further classifies parasitic organisms. The commensals are either 1, *Oikosites*, fixed; or 2, *Coinosites*, free. The Oikosites fish for their own living, and merely ask a free passage from their hosts. They are either fixed in perpetuity, as Coronula, Cochliolepis, Modiolaria, Mnestra, and Loxosoma, temporarily as the Remora Anilocra, Praniza, or only in the young state, *e. g.*, Caligus and Anodon. The Coinosites, on the other hand, never give up their liberty; they occasionally leave their host, and between Coinosite and host there is often an exchange of good offices, one furnishing a solid house or a strong claw, the other a sharp eye, and they

may share their prey in common. The digestive canal is occupied by the following Coinosites:—Fierasper, Stegophyle, Stylifer, Phronimus, Hyperia, the mantle by Pinnotheres and Pagurus, the exterior by Myzostoma, Cyamus, Pycnongonon, Caprella and Chætogaster.

The true parasites cannot live without assistance; they are divisible into several categories. Some, such as the leech, fleas, and some dipterous insects, suck the blood of their victim, and then quit him to take their after-dinner nap in the open air; others, such as the ichneumon flies, do not quit their host till they have become adult, and have in the process exhausted the last drop of blood of their unfortunate prey. The greater number lead a free life when young and merely attach themselves to a host at the time of reproduction, such are the Bopyrian and Lernæan Crustacea. There is a further very interesting group, who enter a host while yet young, simply in order that they may get carried by its means into a second host, where they will ripen their eggs. Often whilst waiting in their first host (sometimes vainly waiting, no doubt) for him to be devoured by their second and ultimate victim they reproduce *agamically*. Such parasites are the Flükes and many Tapeworms. These divisions are thus tabularly set forth:—

Parasites free.

during all their life.	during a part of their life they pass through		
	a single host.		several hosts whilst immature.
Leeches. Fleas and Flies. *Caligus.*	whilst immature. Ichneumons. *Mermis.*	when mature. Bopyrians. Lernæans.	Distomata. Cestoids.

The parasites of the first category which are free during all their life, Professor Van Beneden calls Phagosites, and compares them to the *habitués* of a hotel who avail themselves of the *table d'hôte*, but do not have a bedroom in the building. The other parasites which have both board and lodging are divisible into three principal categories. 1st. Xenosites—who are pilgrims in transit—voyaging with a distinct but distant object in view. They are always agamic, lodge in such closed organs as the brain, muscles, and serous membranes, and wait patiently till they get into the stomach of the animal where they are destined to breed.

The stomachs and appendages of fishes swarm with parasites, and those which have the largest *clientèle* are by no means the least healthy or thinnest. Often one fish, having swallowed another, is swallowed by a third, and thus Xenosites find themselves set free in the wrong fish's stomach, for the stomach acts like a filter, straining out and retaining the parasites, while the flesh is digested. Such erring Xenosites merely wait and may often pass through several "hotels" before they reach their destination. 2nd, Nostosites—those who have reached their destination, and now can abandon themselves to generation. Whilst the Xenosite was obliged to put up often with an uncomfortable cramped lodging, biding his time, the Nostosite occupies the most eligible organs for parasitism—in fact, the most vast and commodious chambers of the hotel. The 3rd division are the Pilgrims, who have lost their way hopelessly, and are in worse plight than even in Giant Despair's castle. Such are the agamic worms which are found often in the Plagiostomous fishes, and who ought to have got into some Teleostean fish, there to fructify—a happy fate forever lost to them when by unlucky chance the host in whom they trusted was swallowed by a remorseless shark. They never quit this retreat.

Prof. Van Beneden gives directions for searching an animal for its parasites, and justly claims a high interest for the study of the fauna of individual species, and urges such neat and sharply-limited zoological inquiries on those who do not feel prepared to study the fauna of a geographical region—to the philosophy of which, indeed, the study of parasite-faunæ may furnish important suggestions. Ninety-three species of fish, with their parasites and commensals, are cited in this work from the author's own observation. Eight plates illustrate it.—E. R. L., in *Nature*.

The Theory of Natural Selection.—In "Nature" for Nov. 10, Mr. A. W. Bennett discusses the theory of natural selection, which he holds to be inadequate to account for the origin of species. Taking as his starting point the two principles laid down by Mr. Darwin himself, that natural selection always operates through the perpetuation of exceedingly small changes, and that every change thus perpetuated by natural selection must be directly beneficial to the individual, he applies these principles to the phenomena of Mimicry, as illustrated in Mr. Wallace's "Contributions to the The-

ory of Natural Selection." Mr. Bennett maintains that in those cases where a butterfly mimics exactly the external facies of a species belonging to a different tribe, the amount of change in the direction of the species ultimately mimicked which can have been established in a single generation, is so small as to be absolutely useless to the individual, and hence, according to one of the cardinal principles of the Darwinian hypothesis, cannot have been brought about by natural selection. He then traces a connection, which he believes to have been overlooked hitherto, between the development of the power of mimicry or protective resemblance, and that of instinct, in the various classes of the animal kingdom, and argues that their parallelism must result from some connection between these phenomena. In conclusion, he contends that Mr. Wallace's abandonment of the theory of natural selection, in accounting for the development of man and of the various races of mankind, is inconsistent and illogical, and that whatever "intelligence," as Mr. Wallace expresses it, has been operative in the origination of man, the same principle must have been at work also in the various lower races of animals. In reply, Mr. Wallace and other naturalists maintain that the steps necessary to transform a butterfly from its normal facies to one imitating exactly an entirely different butterfly of another genus, need not be so numerous as is generally supposed; and that each step may be proved to be directly beneficial to the individual; and hence natural selection is amply sufficient to account for the whole phenomenon. In a subsequent number (Dec. 22) Mr. A. Murray attributes the phenomenon of mimicry to an entirely different cause, that of hybridization, drawing a parallel between the hybridization which he assumes in Lepidoptera and that which is known to take place in plants. This theory is strongly opposed by other entomologists, mainly on the ground that it is unsupported by observed facts, and that from the crossing of plants belonging to different species of the same genus, no assumption can be made that butterflies belonging to entirely different genera and even orders can possibly hybridize. — *The Academy.*

Mode of Life of the Sucking-Fish and Pilot-Fish. — Professor Van Beneden has ascertained the nature of the food of these two forms of fishes. The sucking-fish has sometimes been supposed to derive its nourishment from the sharks, to which it

attaches itself by the curious apparatus on the crown of its head. M. Van Beneden finds that the common sucking-fish (*Echeneis remora*) feeds upon small fishes. From an examination of the contents of the stomach in several examples of the pilot-fish (*Naucrates*) — it would appear that this fish is omniverous — the food consisted of portions of fishes, crustacea, fucoid plants, and, in one instance, parings of potatoes. These observations have been communicated to the Royal Academy of Belgium.—*The Academy.*

African Ant Cats.—The plains of South Africa are characterized by numerous animals generally known to the Boers as "~~mier~~ meer-katjes," or ant cats. Most of these are Viverra, Herpestes, Luricates, etc., and all have nearly similar habits. Early in the morning these pretty animals may be seen in numerous groups sitting upon their hind legs warming themselves in the sun, and when startled, scampering away to their holes, with their tails cocked high up in the air. They all feed on mice, small reptiles, grasshoppers and locusts. They likewise greedily devour birds' eggs. They are more or less colored like the Karoo soil. Mr. Weale also gives in the same letter to "Nature," an interesting account of the protective resemblances of animals in that part of the world.

American Birds in Great Britain.—Mr. H. E. Dresser exhibited to the Zoological Society a specimen of the American Yellow-billed Cuckoo (*Coccyzus Americanus*) recently killed in England, and Sir Victor Brooke a specimen of the Esquimaux Curlew (*Numenius borealis*) lately killed in Ireland.

Wild Rabbits.—Seventy years ago some domestic rabbits were introduced upon Sable Island, a small, sandy islet lying about a hundred miles off the Nova Scotia coast, and being left alone and not crossed in breeding, they have entered their feral state in liveries of beautiful silver grey, with white collars, intimating some remote affinities with bygone races.

Two Ornithological Items.—On the twelfth of last January I shot here a female Evening Grosbeak, out of a flock of about a dozen individuals which was observed several times at Ann Arbor. On the fifteenth of April following, I found the young of the Shore Lark already fledged.—B. Walker, *Detroit, Mich.*

[Although the Hesperiphona is usually quoted as a western bird,

it ordinarily reaches eastward to the Lake Superior region. We have various accounts of its occurrence in Ohio, Illinois, etc., and even in Canada (McIlwraith). In the West, the Eremophila breeds anywhere on the plains suited to its wants, much further south than on the Atlantic border; thus we have found it in New Mexico, in June. But the fact that it nests and lays in March, in Michigan, may not be generally known. — E. C.

The Notes of the Whippoorwill. — Several pairs of Whippoorwills nest near my house. One male bird sits night and morning on the roof of my front piazza, and sings there by the half hour, or even by the hour together. From windows opening upon that roof I observe him at the distance of ten, eight, often of only six feet. The same bird, or his ancestor, has occupied the same post in summer, morning and evening, for several years.

I am not aware that any writer ascribes to the Whippoorwill more than a single note. Wilson, quoted by Samuels, indeed says "When near, you often hear an introductory cluck between the notes." Besides this "cluck" which can scarcely be called a note, the Whippoorwill has *three* distinct notes. There is the common, well known note of Whip-poor-will; heard close by, this note is more nearly "Quipo-o-Will," — the first and last syllables being very quickly and sharply uttered, the last almost like the cracking of a whip; while the second syllable is somewhat prolonged. Accompanying or preceding the first syllable is a sound like the striking of the bird's beak upon a board. The negroes affirm that the noise is so made; but after pretty careful observation, I think they are mistaken. How the sound is made I am not prepared to assert; possibly it is by the snapping of the beak. This is, I suppose, the "cluck" of Wilson and Samuels. Then the Whippoorwill has a note like "Whit, whit, whit" — very soft and musical — often uttered while the bird is upon the wing, yet often uttered also while at rest. It is soft and sweet as possible. Besides these, the bird has a low, harsh, discordant note like "Gor-gor-gor," or occasionally, "Go-ror, go-ror, go-ror." I have never heard this except when another bird was close by. I take it to be a scolding note, or note of defiance when another male bird comes near. While uttering this last note the bird stands erect, with its head raised as high as possible, and its feathers ruffled. While singing "Whip-poor-will" it always lies with its breast flat

to the roof, or fence or whatever it is sitting on. — FAIRFAX, Virginia, July 3d, 1871.

THE BILLFISH IN FRESH WATER. — Mr. G. Brown Goode of the Museum of the Wesleyan University, informs us that a fine specimen of *Belone truncata*, "Green bone," "Billfish" or "Salt water Gar," measuring twenty inches in length, was taken, in June last, in the Connecticut River about thirty miles up, and that he has heard of several other specimens having been taken in the fresh waters of the river, though all the authorities he has been able to consult, give the habits of the species as strictly marine.

There are about fifty species of the genus *Belone* described, and though they are essentially marine fishes of the tropical and temperate regions, yet many of the species are known to live, in great part, at the mouths of rivers, and to ascend to, and thrive in, the fresh waters. It is probably a characteristic common to the whole genus and to the allied genus *Hemiramphus*. Many fishes, generally classed as marine, enter the rivers in pursuit of their food, or for the purpose of spawning, and our local authorities do not always mention such facts in their works, being often more taken up with describing and identifying the species, than in giving accounts of the habits of the fishes that come under their observation. — EDS.

NEW ENGLAND ASCIDIANS. — Prof. Verrill is publishing a series of illustrated articles on our ascidians in the "American Journal of Arts and Sciences." The number for June contains descriptions of some of our compound ascidians which have heretofore been sadly neglected. Several new genera and new species are described. He finds that the young of *Lissoclinum aureum* from Eastport, Maine, contained "tadpole-shaped embryos in an advanced stage of development," while in another species (*L. tenerum* n. sp.) from Newfoundland, the eggs were few and relatively very large. "The development of such eggs is *direct, without passing through a tadpole-shaped larval state.*" This is remarkable, though paralleled in the crustacea, where, for instance the craw fish and several other crabs undergo no metamorphosis while the majority do pass through transformations. In a note Verrill says "with alcoholic specimens it is not possible to trace completely the early stages of this development, or to be perfectly certain that these egg-like bodies are genuine eggs, al-

though some of them appear to contain, at first, a germinal vesicle." The subject is one of great interest, in connection with the supposed kinship of ascidians with vertebrates, if there is anything in the fancied resemblance, which is much doubted by the most cautious and learned comparative anatomists.

Fighting Beetles. — Mr. Lewis exhibited to the Entomological Society of London, an earthen jar, like an ordinary tobacco jar, of Chinese manufacture. It had an enormously thick porous bottom, and it was stated that the inhabitants of Pekin use these jars for the purpose of confining large beetles, which they keep for fighting. The beetles are allowed no food but water, and become extremely ferocious. Prof. Westwood reminded the meeting that the Chinese were already known to keep Mantides for fighting purposes.

Immature Sexuality in Insects. — Mr. Lowne read a paper on this subject before the London Entomological Society. The author thought that species sometimes originated from the maturity of the sexual organization before the acquirement of adult characters; a conclusion he had arrived at in consequence of the early development of the organs in the embryo and larva. He further stated, that, in his opinion, the larval and pupal conditions were probably acquired and not direct stages of development.

The Embryology of Scorpions. — Dr. Elias Metschnikoff has recently published in Siebold and Kölliker's Journal, an elaborate account, highly illustrated, of the embryology of the *Scorpio Italicus* and of a species from Tyrol. The embryology of insects and crustacea as pursued at the present day by zoölogists, who are directing especial attention to the provisional membranes of the egg and embryo, depends almost as much on the skilful use of chemicals as the microscope itself. The author says "the methods which I employ in these researches are not complicated. I study the eggs removed from the ovarian tubes; or, place the living embryo in a drop of a weak solution of salt (salzlösung); or I at first submit them to the influence of solutions of chromic acid of different strengths, and then examine them either with a simple or compound microscope. Out of embryos hardened in this way I can make sections. Much of the time I have to work with dissecting needles, while the embryos or portions of them treated in this

way, and in an equal mixture of fresh and salt water, afford very good objects for study."

The embryology of scorpions was sketched out in a general way by the distinguished German embryologist Rathke. Metschnikoff extends these researches very greatly, and considers as the most important results of his studies the discovery that "in the embryo of the scorpions three embryonal membranes are developed, which, in many respects are very strikingly similar to the Remackian embryonal membranes of the vertebrates."

A South American Bird in the United States. — The specimen of *Erismatura Dominica*, the gift of Mr. Thure Kumlien of Bussyville, Wisconsin, having been presented, Dr. Brewer called the attention of the Boston Society of Natural History to the interest attaching to this specimen. It is a South American bird, and this specimen is the second obtained in the United States. The first, a male, was shot at Lake Champlain, and was presented to the society by Dr. Samuel Cabot. This specimen, the second ever obtained north of Mexico, was shot at Rock River, Bussyville, Wisconsin, November, 1870. It is a female; its total length is fourteen inches; alar extent twenty and one-half inches. The tail consists of twenty very narrow feathers, of which the first is the shortest. The tail extends only three inches beyond the folded wings. Bill one and one-sixteenth inches from base to tip above; one and nine-sixteenths depth at base, and three-fourths of an inch wide. Wing with second primary longest; third and first, even. Iris, brown.

Shad Eggs. — When shad eggs are first impregnated they are very small, but after a short time they swell greatly *and the water in the impregnating pan becomes about* 10° *colder.* — A. S. Collins.

[Can any one give us an explanation of this *fact?* — Eds.]

Discovery of the Animal of the Spongiadæ Confirmed. — Just a line to tell you what you will be glad to learn, viz., that I have confirmed all that Prof. James Clark of Boston, [now of the Kentucky University] has stated about the sponge-cell, and much more too.

It is, after all, only what was published and illustrated in the "Annals" in 1857. Indeed, I am astonished now at the accuracy and detail of that paper ("Ultimate Structure of Spongilla," etc.), now *all* confirmed by an examination of a *marine* calcareous

sponge. I have not only fed the sponge with indigo, and examined all at the moment, but the sponge so fed was put into spirit directly afterward, and *now* shows all the cells (monociliated) with the *cilium attached and the indigo still in the cells.*

This, I think, will break down Häckel's hypothesis, which is as imaginative and incorrect as it is beautiful.

His "Magosphæra," too, is figured in the "Annals" (1856), and described *in extenso* as the amœboid cell which inhabits the mucus of the cells or internodes of the Bombay great *Nitella.*

But there are no people in England, if on the Continent, who seem to be able to show this, if even they be cognizant of it.

Ex oriente lux used to be the old phrase; the light is now being *reflected* back from America. It is from there that we must expect novelties now. — H. J. Carter, *in Annals and Mag. N. History.*

GEOLOGY.

Rocks Polished by Sand. — Dr. Kneeland, at a meeting of the Boston Society of Natural History, exhibited several specimens of glass, marble and hard stones engraved, carved and grooved by the action of sand driven by a blast of air or steam. The surface being covered with perforated paper or a stencil plate, the parts exposed by the perforations are cut rapidly and accurately, while the covered parts are untouched; protected, it is supposed, by the elasticity of the paper or metal. He drew attention to this industrial process as illustrating the advantage of diffusing, as a common branch of knowledge, information on the forces of nature, and, in this instance, on dinamical geology. This process which promises to revolutionize one of the most extensive of the industrial arts, is simply carrying out what natural forces have been doing to the surface rocks of our continent for ages. Sands carried by strong and steady winds, passing over rocks, often wear them smooth, or cover them with grooves and scratches, as noticed and figured by Mr. Blake in the granite rocks at San Bernardino Pass, California. (See Pacific Railroad Reports, Vol. V. pp. 92 and 231.) Quartz rocks were there found polished, the softer feldspar being cut away; where the latter had been protected by garnets, projections were left, tipped with the hard garnets, pointing like fingers in the direction of the wind.

On the surface of the Great Colorado desert the pebbles are finely polished by the drifting sand, or variously grooved, according to the hardness of their substance. Prof. J. Wyman also mentions that glass windows on Cape Cod have holes worn in them by the drifting sands blown by the winds.

It is the tendency, Dr. Kneeland remarked in conclusion, of modern education to pay less attention to the dead languages and to ancient history as a means of culture, and more to the practical and living issues of the day, and especially to combine a knowledge of natural phenomena with the elementary instruction of the schoolroom. In this particular instance it is altogether probable that, if the grooving of rocks by the wind-driven sands, long known by geologists and physicists and by them turned to no practical account, had been equally well known to our intelligent and skilful mechanics, the process here illustrated would have been invented years ago, and by this time have attained a high degree of perfection. The same reasoning will apply to other departments of natural and physical science, and goes to show the wisdom of those educators who are endeavoring to diffuse a knowledge of scientific principles and phenomena among the people.

Fossil Reptiles from the Rocky Mountains. — Prof. Marsh is continuing in the "American Journal of Arts and Sciences" his descriptions of the reptiles obtained during his recent expedition to the Rocky Mountains. He remarks that "the specimens from the Cretaceous formation are of great interest as they further illustrate the remarkable development in this country, both in numbers and distinct forms, of the Mosasauroid reptiles, which appear to have been comparatively rare in other parts of the world. Fortunately, moreover, some of these remains serve to clear up several obscure points in the structure of these reptiles, and prove conclusively that they had a well developed pelvic arch and posterior limbs; although up to the present time no satisfactory indication of this had been discovered, and the eminent palæontologists who have recently made these animals an especial study, consider them probably destitute of these extremities. The remains found in the Tertiary deposits are also of importance, since they show that types of reptilian life, almost unknown hitherto from that formation in the West, were, in one of the ancient lake-basins, at least, abundantly represented during that period." The

cretaceous reptiles are *Edestosaurus dispar* and *velox* and *Clidastes Wymani* and *pumilus*. Five new species of crocodiles, and land lizards belonging to a new genus (*Glyptosaurus nodosus*, *ocellatus*, and *anceps*) were found in the Tertiary deposits.

New Facts in Fossil Botany.—The first point mentioned was the occurrence in the Devonian Shales of Kettle Point, Lake Huron, of beds containing immense quantities of spore-cases, probably of Lepidodendron. These beds are referred by the Geological Survey to the horizon of the Genesee shales of New York, and are stated to be twelve or fourteen feet in thickness, and to extend over a considerable area of country. Specimens in the collection of the Survey show that the bituminous matter which causes the combustible quality of the shale, is due entirely to the immense quantities of spore-cases present, which, under the microscope, appear as flattened discs scarcely more than one hundredth of an inch in diameter. Specimens of the trunks of *Lepidodendron Veltheimainum* and *Calamites inornatus* occur in the same beds. This is probably the oldest bed of fossil spore-cases known; but in later geological periods similar beds occur, the Tasmanite, or 'white coal' of Tasmania, which consists of spore-cases of ferns, being a notable instance. The author next referred to the discovery of specimens indicating the existence of three or four species of Tree-Ferns in the Devonian of New York and Ohio. He had received from Prof. Newberry of New York, a specimen, showing the upper part of a stem with five leaf stalks attached to it. This he had named *Caulopteris Lockwoodi*. Three other specimens collected by Prof. Newberry in Ohio indicated the existence of three distinct species belonging to two genera. The two most important had been named by Prof. Newberry *Caulopteris antiqua* and *Protopteris peregrina*. They are from the Corniferous Limestone, and thus carry down tree-ferns to the bottom of the middle Devonian. One of them has the cellular structure and vascular bundles in such preservation as to show their microscopic structure, which is precisely similar to that of modern ferns.—Principal Dawson, in *Nature*.

The Persistence of Palæozoic Types of Madreporaria.—The dredging expedition which searched the sea-floor in the track of the Gulf Stream of 1868, yielded, amongst other interesting Madreporaria, a form which has been described by Count Pourtales

under the name of *Haplophyllia paradoxa*, and which was decided by him to belong to the section *Rugosa*.

The last expedition of the Porcupine under the supervision of Dr. Carpenter and Mr. J. Gwyn Jeffreys, obtained, off the Adventure Bank in the Mediterranean, many specimens of a coral which has very remarkable structures and affinities. The species is described by Prof. P. Martin Duncan, under the name of *Gwynia annulata* Dunc. The necessity of including it amongst the Rugosa and in the same family, the *Cyathoxonidæ*, as *Haplophyllia paradoxa*, is shown by him in a paper read before the Royal Society of London. Having this proof of the persistence of the rugose type from the Palæozoic seas to the present, the affinities of some so-called anomalous genera of Midtertiary and Secondary deposits are critically examined. The Australian Tertiary genus Conosmilia three of whose species have strong structural resemblances with the Rugosa is determined to be allied to the *Stauridæ* and especially to the Permian genus Polycœlia. The Secondary and Tertiary genera with hexameral, octomeral, or tetrameral and decameral septal arrangements are noticed, and the rugose characteristics of many lower Liassic and Rhetic species are examined. The impossibility of maintaining the distinctness of the Palæozoic and Neozoic coral faunas is asserted; and it is attempted to be proved that whilst some rugose types have persisted, hexameral types have originated from others, and have occasionally recurred to the original tetrameral or octomeral types; and that the species of corals with the confused and irregular septal members, so characteristic of the lowest Neozoic strata, descended from those *Rugosa* which have an indefinite arrangement of the septa. The relation between the Australian Tertiary and recent faunas, and those of the later Palæozoic and early Neozoic in Europe, is noticed, and also the long-continued biological alliances between the coral faunas of the two sides of the Atlantic Ocean.—*Nature*.

Crinoids injected by Silicates. — Dr. T. Sterry Hunt made a communication to the Natural History Society of Montreal, April 24th., on a Mineral Silicate injecting Palæozoic Crinoids.

The author described a gray granular Palæozoic limestone from New Brunswick, which had been examined by Dr. Dawson, and found to consist almost entirely of the comminuted remains of brachiopod and gasteropod shells, crustacea, and the joints and

plates of crinoids, cemented with a little calcareous spar. The crinoidal remains were, however, found to have their pores filled with a peculiar silicate, which is exposed in relief when the surface of the limestone is attacked by an acid, and then appears as a congeries of small cylindrical rods or bars, anastomozing and forming a beautiful net-work, which, under a magnifying glass, exhibits a frosted crystalline surface, and resembles the variety of arragonite known as *flos ferri*. This silicate, which also fills small interstices among the other calcareous fragments making up the limestone, is greenish in color and forms about five per cent of the rock. Though insoluble in dilute acids, it is completely decomposed by strong acids, and is found to be a hydrous silicate of ferrous oxide and alumina, with some magnesia and a little alkali, closely allied to fahlunite and to jollyte. The results of its analysis appear in "Silliman's Journal" for May.

Dr. Hunt remarked that this process of infiltration, by which the minute structure of these Palæozoic crinoids has been preserved, was precisely similar to that seen in the glauconite casts of more modern foraminifera, and in the Eozoon of older times. This ancient calcareous rhizopod, though most frequently preserved by serpentine, had been shown by himself in Canada and by Hoffman in Bohemia, to be in some cases injected by silicates related in composition to that of these crinoids. He then proceeded to speak of the great class of silicates of which serpentine, loganite, pyrosclerite, fahlunise, and jollyte are members, and which are generally described as the results of pseudomorphic changes of preëxisting silicates or carbonates, but which he, since 1853, has maintained to be original aqueous depositions, similar in their origin to the related mineral glauconite; a view now adopted by such investigators as Naumann, Scheerer, Gumbel and Credner. He noted in this connection the bearing of these facts on the *Eozoon Canadense* of Dawson, the organic nature of which, though almost universally admitted by zoologists and mineralogists, was nevertheless still questioned by Messrs. King and Rowney. These gentlemen object that the ancient rocks in which Eozoon is found are what are called metamorphic strata, which have been, according to them, subjected to pseudomorphic changes, and therefore, the Eozoon may be the result of some unexplained plastic force, which has fashioned the serpentine and other mineral silicates into forms so like those of foraminiferal organisms as to deceive the most

practical observer. This, said Dr. Hunt, was going back to the notions of those, who, rather than admit that mountains had been formed beneath the sea, imagined that the fossil shells which they often contain were not the real shells of animals, but the result of some freak of nature. The argument of Messrs. King and Rowney that the Eozoon rock is a result of pseudomorphic alteration because it contains serpentine, is a begging of the question at issue, by asking us to admit that the presence of serpentine is an evidence of metamorphic change, which is denied. He then remarked that the specimens of this organic limestone, with its injected crinoids, differed from Eozoonal rock only in containing at the same time recognizable fragments of other organic remains, and in presenting in its injected portions the differences which distinguish the minute structure of a crinoid from that of a calcareous rhizopod. In conclusion, he again adverted to the views which he had long maintained as to the origin of great masses of silicated rocks by a direct process of deposition from watery solutions, in which they were formed by chemical reactions.

Dr. Dawson spoke, confirming the observations of Dr. Hunt, which he had verified by microscopic examinations. He alluded to the structure of crinoids, which in the fossil state were generally filled with carbonate of lime so as to obliterate their pores. The infiltrating silicate in the present case however, showed, especially in decalcified specimens, that these ancient crinoids closely resembled in their minute structure, the modern forms lately studied by Dr. W. B. Carpenter and Professor Wyville Thompson, especially Comatula. Figures of these decalcified specimens were exhibited and will be published. Dr. Dawson alluded further to the process of filling up the porous calcareous skeleton of the crinoids, which was clearly shown to be prior to the cementing and consolidation of the fragmentary limestone.

MICROSCOPY.

The Submersion Microscope. — R. E. Dudgeon, M.D., describes under this name, in the Quarterly Journal of Microscopical Science for July, 1871, a contrivance by which the objective of an ordinary microscope can be plunged in water without affecting its optical qualities. A brass tube with its lower end closed watertight by a flat disc of glass is slipped over the objective from

below so far that the glass disc is considerably within the working focus of the lens. Thus protected the lens can be lowered into water, syrup, glycerine, etc., to a depth limited only by the mechanism of the microscope or the length of the protecting tube, and used to view objects floating in the liquid or lying on the bottom of the vessel containing it. While the common "tank microscope" can be worked best somewhat horizontally, through the side of the tank, this arrangement, besides being applicable to much higher powers, is adapted to give a more or less vertical view, being entirely free from any tremor on account of the motion of the top of the water, and is therefore especially useful for dissecting purposes. Its object, though not its method, is identical with that of Tolles' immersion objective for low powers, published more than two years ago; though the latter naturally possesses, being constructed especially for this use and dispensing with two unnecessary surfaces of glass, some optical superiority as well as a much longer working focus. The submersion tube, being applicable to ordinary lenses, only slightly lowering their magnifying power and considerably shortening their working focus, will doubtless be extensively useful; though the statement that it may be always retained in position as a protecting cover to the lens without impairing the definition or illumination in ordinary work, must be considered as too enthusiastic. It is especially applicable to lenses of from one inch to one-quarter inch focus (the latter limited to a very small angle), and the objects should be placed in a jar or tank having the bottom and at least one side quite smooth and transparent. — R. H. W.

NOTES.

Prof. C. F. Hartt, who has already become identified with Brazilian geology, zoology, and archæology, from his three former expeditions, in the first being an assistant to Prof. Agassiz on the Thayer expedition, left New York on July 24th for another and more extensive exploration of the eastern part of the valley of the Amazons. He will continue the series of geographical and geological investigations begun on his last journey, and expects on his return to be able to publish a detailed account of the region

examined. The principal points to be investigated are the following:

1st. The character and distribution of the Palæozoic rocks bordering the valley on both sides. Last summer he found Carboniferous rocks on the Tapajos, and Devonian beds near Monte Alegre. More complete suites of the fossils afforded by both these formations will be made, so that the faunæ of the Carboniferous and Devonian of Tropical America may be illustrated and compared with those of North America and Europe.

2d. A search for Mesozoic rocks will be continued, none having yet been discovered east of the Purús.

3d. The Tertiary beds forming the Table topped hills will be carefully studied at Almeyrim and the Serra da Paranáguára, and the height of these hills will be measured.

4th. The deposits of the lower plain will be reëxamined, and in this connection a journey will be undertaken across the Island of Marajó.

5th. The shell banks, terraces, etc., on the borders of the valley will be explored to determine, if possible, the character and amount of the last uprise of the Amazonian region.

6th. The Indian mounds of Marajó will be explored.

7th. He will employ native guides, and continue the study of the Lingoa Geral, or Modern Northern Tupí.

Mr. Orville A. Derby, who distinguished himself on Prof. Hartt's last expedition, accompanies Prof. Hartt as special assistant. The latter has already had several months' experience in photography and goes furnished with apparatus for taking a series of views with which to illustrate his next volume. A popular illustrated sketch of the journey will appear immediately after his return, as we understand, in the columns of "Every Saturday." As extensive a collection of zoological, geological and ethnological specimens will be made as possible.

The expedition, though in the interest of Cornell University, has been privately gotten up. The greater part of the fund has been furnished by Col. Edwin Morgan of Aurora, N. Y., who also bore a large part of the expenses of his last expedition, and, in recognition of the kindness of this gentleman, Prof. Hartt has given to this exploration the name of the MORGAN EXPEDITION. Prof. Hartt has received considerable pecuniary aid from private individuals, and the Peabody Museum of Archæology has placed

five hundred dollars in his hands to be used for archæological purposes. As the expedition will be limited by the amount of funds subscribed for the purpose, we trust that some of our liberal countrymen will contribute to keep Prof. Hartt in the field as long as possible. Subscriptions will be received by Major O. C. James, P. O. box 6001, N. Y., or by Mr. E. G. Putnam, Business Manager of Cornell University, Ithaca, N. Y.

From Prof. Hartt's very extensive knowledge of the country and native languages, his well known accuracy of observation and former extended field work in the geology of North America, we believe that his return will make known many facts of the greatest importance to science, and that both Mr. Morgan and the Cornell University will be proud of the results attained by their indefatigable worker.

None of the entomological collections in Paris, says *Petites Nouvelle Entomologiques*, have suffered much. Those of the Museum were unharmed, and those of MM. Chaudoir, Sallé, Boisduval were also uninjured.

Mr. G. R. Crotch is to spend a year collecting insects in California and Oregon, and thence proceed to Australia and other places in the East. Dr. LeConte is to work up the American beetles collected by him.

Dr. Boisduval has been at work during and since the siege of Paris in finishing his work on the Sphinges of the world. This work, which will fill up one of the gaps in the *Suite à Buffon*, will form the fourth volume of the *Histoire Naturelle* des *Lepidoptères;* it will comprise the Sphingidæ, Castniæ, and Agaristæ.

The great work by the Messrs. Felder on the Lepidoptera of the Novara (the Austrian) exploring expedition will be completed this year. It will contain a complete classification of the moths, and will supplement Guénée's work on them.

Our next issue, which will probably be out by the middle of the month, will constitute Nos. 8 and 9, containing the Address of President Hunt before the American Association for the Advancement of Science, and the papers read before the Natural History Sections of the Indianapolis meeting. The publication of this double number will enable us to close our volumes with the close of each year; an end as much desired by our subscribers as by the proprietors.